THE

VETERINARY JOURNAL

SEPTEMBER, 1907.

THE LATE D. HUTCHEON, M.R.C.V.S.

Director of Agriculture for the Cape of Good Hope.

BORN JUNE 22, 1842. DIED MAY 14, 1907.

By the death of the late Director of Agriculture on the 14th of last month, South Africa has sustained an irreparable loss. He was not only a great authority on animal pathology, but a deep and earnest student of all the problems which face those who undertake to engage in agricultural pursuits in this country. That his death came as a great shock to the whole community, and was felt throughout the length and breadth of the land, was amply demonstrated by the marked expressions of public regret exhibited at the time; but it is only those who have been intimately associated with him who can appreciate to the full the value of the man and the really great work he has accomplished and endeavoured. From the moment Mr. Hutcheon came to South Africa to the day he left his office never to return, he was engaged in a continuous struggle against forces which more than once threatened to overwhelm one or other section of the agricultural community. Fortunately for South Africa he was possessed of a great and enduring courage as well as a firm belief in the magnitude of the truths it was his duty to inculcate, and though, on occasions, he knew he was carrying his life in his hands, he fearlessly persisted with his work, looking only to the goal ahead and ignoring the incidents by the way. His earlier experiences in this country were far from encouraging. He came here, after a brilliant college and professional career in Scotland, England, and Ireland, to take up the duties of Colonial Veterinary Surgeon. He stood, as it were, alone in a wilderness. In those days veterinary science was little known to the average South African farmer, and for many years he had to struggle against prejudices and discouraging criticism, founded on open distrust, which would have disheartened the majority of men. In the end, however, he conquered, and to-day the services of the veterinarian are eagerly sought where they were despised as useless a few years ago. The only reward he ever hoped for was that some day he might be placed in a position to give this country the full benefit of the knowledge he had acquired during the lengthy and strenuous period he had devoted

to its service. That opportunity came, but, unfortunately, it came too late. As Director of Agriculture he was placed in such a position. This office was quite unsought, and for some time he hesitated to accept it; for his one ambition, as read by himself, was to be able to devote his attention entirely to veterinary work in the interests of this country quite untrammelled by any other consideration. And, unfortunately, when he took up the post of Director, he was beginning to be handicapped by failing health. A wide field was now before him, and, in spite of warnings which would have caused other men to pause, indications and indispositions which told him that even his iron frame was beginning to be shaken, he threw himself with unflagging energy into the duties he was called upon to fulfil, and by persistent attendance at his office, early and late, and by moving about freely among the farmers, he succeeded in getting through an enormous amount of work. It was only when collapse was imminent that he acknowledged defeat, and then it was too late, for the end came only too rapidly. He was in his office on May 7, on the 14th he had passed away for ever. His charming personality and beautiful disposition gained for him a whole host of friends in every part of South Africa, while in most of the pastoral districts his name was, and will remain for many years to come, a household word. He has left behind a number of writings on stock diseases in this country, and was engaged on the compilation of what he hoped would have been the crowning effort of his life, a *magnum opus* in the shape of a complete work based on the result of his investigations, when death intervened. The loss of such a man at such a peculiar juncture amounts almost to a national calamity; and by none is that loss felt more than by those who have been associated with him in his official duties. To all he was ever a sympathetic and a wise friend, but to the officers of this Department he was much more. His wide knowledge, his wisdom and tact, his unselfish generosity and love of justice, will keep his memory green for ever with all who have had the privilege of serving under him. He laid the foundations of scientific knowledge of the stock diseases peculiar to this country, and always encouraged his subordinates to further efforts in that direction. He never sought honours or distinction, and to the roll of his early academic successes added nothing but the title of Hon. Associate of the Royal College of Veterinary Surgeons, a distinction conferred upon him by that body in 1902 as some recognition of his great services to veterinary science.

Mr. Duncan Hutcheon was born near Peterhead, in Scotland, in 1842, and received his early education at the parish school of Old Meldrum, Mollison's Academy, Aberdeen, and at some privately-conducted evening classes. He began life as an agricultural assistant, and it was in this capacity that he obtained his first experience in the care of livestock. In 1858 he joined the Dick Veterinary College, Edinburgh, where he soon distinguished himself, obtaining the Dick Bursary of £30 per year for three years at the close of the first session, the conditions attached being that for the whole period he should occupy the position of assistant to the principal, Mr. Williams. In 1871 he obtained the diploma of the Highland and Agricultural Society, also that of the Royal College of Veterinary Surgeons, passing with distinction, and winning the silver medal for anatomy, physiology, chemistry, materia medica, and hippopathology, and the Highland

Society's medal for the "Best general examination." On leaving College, he practised for a time with Messrs. Pollock and Sons, in Edinburgh, and in 1872 he conducted a practice in Limerick for Mr. O'Connor. In the following year he joined Mr. Arthur Santy as assistant at Castle Meadow, Norwich, then one of the largest practices in the Eastern counties. After two years' work there he was appointed veterinary surgeon to the Liverpool Omnibus and Tramway Company, where he remained until leaving to take up a position as Colonial Veterinary Surgeon to the Cape Government on March 2, 1880. He had only been in South Africa a year when the outbreak of pleuro-pneumonia in Angora goats, introduced from Asia Minor, called for his special attention. This disease broke out in 1881, and proved most destructive. Had it not been for Mr. Hutcheon's measures in carrying out preventive inoculation on an extensive scale, in conjunction with strict quarantine regulations, the whole Angora goat industry in South Africa would have been imperilled. He received the thanks of Parliament for this work, together with a special bonus, and was presented by the Angora farmers with a gold watch and chain, a large gold cup, and a binocular microscope. From that time onward he devoted all the time he could spare from his general duties to investigation work. It was he who first determined "blue tongue" in sheep (malarial catarrhal fever) as a specific disease, and under his directions Mr. Spreull succeeded in producing a preventive serum for immunising sheep against that disease. In 1883-4 came the terrible wave of red-water in cattle, which threatened to render cattle farming impossible in the east coast districts. Then came heartwater in sheep, and at that time, as the part the tick played was unknown, the whole position looked hopeless. Fearless and untiring were his labours in those days, and they laid the foundation for the more complete work carried out later, when Mr. Lounsbury took up his share of the investigations, and our farmers were made aware of the devastating influence of the tick. But probably the most strenuous of the many campaigns the late Mr. Hutcheon waged on behalf of the farmers of this Colony was that against rinderpest, when that fell disease broke out in 1896. He directed and controlled the struggle to keep it in check, seemingly indefatigable and inexhaustible. He covered thousands of miles of country, and did everything that was humanly possible to hold it back, pending the discovery of some system of rendering cattle immune. The methods of inoculation were ultimately introduced, when the pressure on the Colonial Veterinary Surgeon and his staff was eased. He was appointed Acting Director of Agriculture in August, 1905, that appointment being confirmed the following year.

(*Agricultural Journal of the Cape of Good Hope.*)

Editorial.

THE PROPOSED ANNUAL REGISTRATION FEE.

In our last issue we anticipated that the committee appointed by the Royal College of Veterinary Surgeons to consider this question would adopt the suggestion of circularising the profession. We have since received a copy of the circular which has been sent to each of the members of the profession, and we have considered it advisable to reprint it for purposes of reference. We expressed ourselves as being unreservedly in favour of the principle and the suggested method of putting the Royal College on a sound financial basis, and we are glad to see, judging by the discussions at some of the meetings of Veterinary Societies, that the suggestion is meeting with wide and popular support. At the recent meetings at Leeds and Dublin the proposition was the subject for discussion, and the speakers were largely in accord in supporting the principles involved, the points of disagreement being chiefly matters of detail, opinions which would readily be sacrificed to the opinions of the majority. Several people have suggested that it will inflict a hardship on the struggling beginner and veterinary surgeons in low water, but the Council "confidently believe that the benefits which can thereby be secured to the individual members of the profession will far outweigh the sum which each member will be called upon to pay." We certainly endorse Mr. McKenny's statement on the same point when he says: "It would, indeed, appear to me that it is the less fortunate ones who should be the most ardent supporters of the measure, for while to the fortunate of the profession a strengthened R.C.V.S. can merely mean a more honoured profession, to the struggling beginner it holds out the certainty of vigorous protection against ills for which he is no match, and to which if his efforts be unaided he must ultimately succumb."

Mr. McKenny very pertinently asks, "Are we wise for ourselves, collectively and individually, or mindful of the honour of our profession, to delay strengthening to the best of our ability any organisation which we have for advancing and protecting the interests of our profession, and in addition devising new and more complete methods whereby we may enjoy those rights and

that freedom without which no profession can flourish?" We think everybody will admit with Mr. McKenny the lack of wisdom in further delay. Mr. Wallis Hoare also gave a striking paper in Dublin in favour of the suggestion, and he was very happy in his concluding quotation from Bacon, which we also commend to the consideration of our professional brethren: "I hold every man a debtor to his profession, from the which, as men of course do seek to receive countenance and profit, so ought they of duty to endeavour themselves by way of amends to be a help and ornament thereto."

Original Articles.

AORTIC WORMS FOUND IN THE BUFFALO IN THE FEDERATED MALAY STATES.

BY T. A. FORD, F.R.C.V.S.

In the Malay Peninsular are found a large number of water buffaloes, which are particularly interesting as they harbour some of the most unusual of Nematode worms, two, if not three, distinct species being found in varying numbers in the aorta of these animals, but it is with only one of them I wish to deal in this paper.

So far as I have been able to search, no mention has ever been made of these parasites, nor can I find in any published work on Helminthology I have had access to, any mention of parasites at all resembling them.

Description of Water Buffalo (ultimate host).

As these animals are natives of this part of the world they breed readily, although in the Federated Malay States they are largely imported from the more southern states of Siam, principally for slaughter. The water buffalo is a ruminant, and when alive weighs from 600 to 1,000 lbs., with thick, short limbs and a massive neck. There is no dewlap. The skin, which is much thicker than in the ox, is generally black in colour and sparsely covered more or less all over with long coarse black hair, thickest on the shoulders, neck and pole. In some the skin is a dirty greyish pink, and in this case the hair is white. On the hairs are usually found a varying number of louse ova. Horns are supported by horn cores, prolonged to about one-third of the entire length; they are irregularly elliptical, and the upper surface is deeply ridged to within about the last third of the length. The length of horn varies with the age of the animal, and may measure as much as from 5 to 6 feet from tip to tip, measured along the concavity. Its curvature is outwards, upwards and at the point slightly inwards, forming somewhat of a semi-circle. When walking the head is carried extended on the neck, and the horns then lie parallel to the neck.

Movements of the animal are usually slow and sluggish, but a good speed can be attained when the animal is frightened or disturbed.

The chief use these animals are put to is to trample and plough the paddy fields, hauling logs of timber from the jungle to the roads, and in puddling clay for brick-making. They invariably harbour a number of lice, and spend a great part of their time, when not at work or feeding, in shallow mud pools (called Kubang by the Malays), wallowing and covering themselves with mud; this, I believe, is to protect themselves from the attacks of the various blood-sucking flies, of which there are several varieties, and which are very numerous in the country districts.

Anatomy of the Buffalo's Aorta.

This does not essentially differ from the aorta of the ox. The vessel arises from the base of the heart as the common aorta, and after a very short course divides into the anterior aorta, only about an inch or an inch and a half long, and the posterior aorta, which passes backwards under the spinal column, and after giving off intercostal and abdominal branches, terminates in the middle sacral artery, after supplying the vessels for the pelvic limbs. Structurally the vessel is the same as in the ox, but rather longer, more elastic and thicker.

Description of Tumours and Worms.

On opening a buffalo's aorta, the tumours, with the female worms attached, are readily seen. The free portions of the worm's body correspond to the flow of blood backwards along the vessel when situated in the posterior, and forwards when in the anterior aorta.

Both tumours and parasites vary in size, from the young recently developed tumour and worm, perhaps not more than $\frac{1}{8}$ inch high and $\frac{1}{2}$ inch long, to a height of $\frac{1}{2}$ inch and a length of parasite up to and even over 1 foot, in the mature condition.

Never more than one female worm was ever found to be connected with a tumour, but as many as ten males have been taken from one tumour on one occasion.

The tumours and worms are usually attached to the wall of the posterior aorta, though they are occasionally found in the anterior, and I have seen them in one instance (only one tumour and worm) in the short trunk common to the two carotids, just before they bifurcate right and left.

The frequency with which this condition is met with is shown by the fact that, out of a total number of ninety-three aortas systematically examined, sixty-seven, or 72 per cent., contained worms. The total number of worms found was 306, or an average of nearly 3·5 for all examined. In only seven instances out of the sixty-seven aortas containing worms and tumours were these conditions found in the anterior aorta.

The number of tumours and worms found in each aorta varies. I have found as many as twenty. They are generally found in the posterior aorta, and mostly situated in the thoracic portion of the vessel, but although not uncommon, they are much more rarely found in the anterior aorta; more rarely still only one worm may be found in the whole aorta, and that situated in the anterior. However, it may

be generally stated that the number of worms usually present in the buffalo's aorta varies from two to five.

The anterior part of the female worm is firmly attached to the posterior part of the tumour, when this is situated in the posterior aorta, and conversely, the anterior portion of the tumour, when this is situated in the anterior aorta. The smooth endothelial covering of the tumour is prolonged for a short distance around the worm in the nature of a short sheath.

FIG. 1.—Aorta of Buffalo, opened, showing worms *in situ*.

Just within the tumour the parasite becomes much finer (less than half as thick as the exterior portions), and an S-shaped turn is made, which is firmly embedded and difficult to separate away from the dense mass of cell *débris* and calcareous particles of the tumour. This, I think, is a provision of nature to resist the traction, which must be continuously exerted at a fairly constant pressure, on the free portion of the parasite to prevent it being separated from the tumour, which would probably occur owing to the rush of blood at its highest pressure and most rapid flow in the whole body. It is probable that the sheath formed from the tumour covering assists in this direction also.

The tumour varies in height and diameter with the age of the parasite. It is composed of cells of the fibrous tissue variety, cell *débris* of a somewhat caseous nature in the younger forms, and caseous and calcareous particles together with these in the older ones. It is

covered externally with a layer of flattened endothelial cells, continuous with the endothelium of the tunica intima, and this layer of cells is thickened where it joins the intima of the aorta.

On the anterior face of the tumour, generally near the floor of the aorta, a small gelatinous and red globular mass is seen, and on removing this a very minute opening can be made out, through which it is conceivable the parasite obtains its food. There can be no doubt this worm lives on the blood of the host, as in nearly all cases the alimentary canal can be easily made out, through the living body, by reason of the colour of its contents, which is reddish-brown or brown, and the intestinal contents examined microscopically show red blood corpuscles. It will be understood these remarks apply only to the fresh specimen.

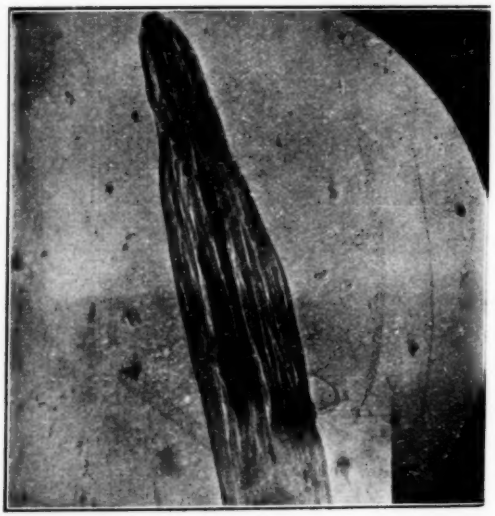

FIG. 2.—Head of female worm, showing embryo emerging.

One can in almost every case find the male worms varying in number, usually two or three, coiled up within the tumour, and a few particles taken from the interior of the tumour almost always show a varying number of embryos when examined under a low power of the microscope ($\frac{2}{3}$ or $\frac{1}{6}$ objective). One or two cases which were examined in this way showed no embryos, but at the same time no male worms were found either, so that I think there can be no doubt about the absolute differentiation of the sexes, that the parasites are of a fairly high order, and certainly not hermaphrodite.

The female worm is round, and varies in length according to its age. I have seen it only measuring $\frac{1}{6}$ to $\frac{1}{2}$ inch, but it is very rare indeed to find them so small, and they may attain a length of 10 to 12 inches from the point of emergence at the tumour, so that, dissected out, and adding the portion enclosed within the tumour, about 1 inch,

this parasite may reach a length of over a foot, an enormous length when its position in the host is considered.

The colour of the female worm is an opaque white in all its larger portions, but both the head and tail for a short distance are translucent. The opacity is due to the distended coils of the uterine tube. In the fresh specimen one has to be very careful in handling one of these worms, as, owing to the distended condition of these tubes, the body is very easily ruptured; when this occurs, and the white, opaque liquid is examined microscopically, embryos and ova in all stages of development are seen.

The intestine is seen as a thin brown streak, and the anus is situated very close to the tip of the tail.

The opening of the genital system is situated close to head, in that portion of the worm confined within the tumour.

The cuticle is firm and segmented from end to end.

The male worm, which is white and opaque throughout its entire length, is much smaller in every way than the female, usually only about 1½ to 2 inches in length, and about the thickness of fine sewing cotton. The tail is curved.

The body of the male worm is completely enclosed in the tumour, though the head may occasionally be found projecting through the minute orifice I have already mentioned, situated in the front of the lower portion of the tumour.

The intestine of the male, contrary to that of the female, is rarely coloured, and does not contain red blood corpuscles; it ends in the cloaca, situated very near the tip of the tail, and the spicule terminating the vas deferens (penis proper) is easily seen under a ⅔-power magnification. The penis can be seen, in a fresh specimen, moving in and out of its surrounding sheath.

Both male and female worms have fairly active movements when placed in water or normal salt solution, and even when cut into pieces each piece has the power of movement, more especially the head and tail.

Anatomy.

Structure as seen in a transverse section: Externally a tough sheath surrounds the worm, next to which lies a narrow cuticular layer; beneath this is the circular muscular coat, and then the longitudinal, the thicker of the two. These layers are thicker over the dorsal and ventral than the lateral regions.

The intestinal canal is distinguished by its flattened shape and cutical granular epithelium, evenly laid out. The uterine tube presents an uneven epithelium lining its interior, due to the cells projecting inwards; these cells are never many, and in sections usually six or eight are seen. There is no regular water vascular system.

Digestive System of Female Worm.

Mouth anterior and surrounded by an oral ring. In the living state this mouth is very retractile, coming in and out of the ring with great vigour.

Œsophagus, also an extremely retractile tube, measuring quite 7 mm. in length, and appearing in the fresh specimen as a white

opaque tube. When stained and preserved in glycerine it shrinks into a spiral tube, looking wavy instead of straight. The canal itself is very narrow, and appears as a slit between the thick walls. Along its course the œsophagus is crossed over at many places by the uterine tube, which is the only other visible tube in this part of the worm.

After a course of about 7 mm. the œsophagus becomes suddenly dilated into a bulbous stomach, which as such is continued further on as the intestine, without, however, any visible differentiation. The intestine is nearly straight, and terminates in the anus, which is subterminal, and situated about 2 or 3 mm. from the tip of the tail. The stomach and intestine are brownish-red in colour, not opaque like the œsophagus. The colouration is due to the presence of half-digested

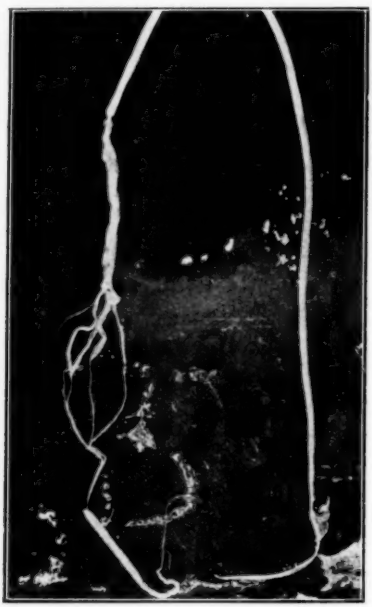

FIG. 3.—Female worm, showing uterine tube breaking up into four tubules.

blood present along its whole length. Under the microscope the contents of this part of the intestinal canal show large numbers of blood corpuscles.

About 5 mm. from the mouth two gland-like structures (salivary glands ?) appear to be attached to the œsophagus, and held in position by some transverse fibres from the circular coat. Beyond these two gland-like structures opening into the œsophagus, there is no evidence of any other opening into the alimentary system.

NERVOUS SYSTEM.

At the oral ring there is a circular cord-like structure, with a longitudinal branch springing from it on either side. These two cords

cannot be traced far down, as they disappear in the meshes of the longitudinal muscles. No ganglion swelling has been noticed.

Genital System (Female).

The genital or vaginal opening is situated ·65 to ·75 mm. from the mouth. It lies on the ventral surface, and under exceptional circumstances can be made out as a distinct slit. These rare occasions occur when the living embryos are seen escaping from the vagina. Through this opening the mature embryos, with their sheaths already cast off, escape.

During life the uterine tube may be noticed to terminate abruptly at this region, but the genital opening is not obvious, and there is no papilla. In the fresh state it can be recognised by:—(1) The escape of embryos. (2) A discharge soon after the escape of each embryo, consisting of fluid and granular *débris*. (3) The detection of a narrow passage representing the vagina, which can be made out by careful focussing, and which leads to a slightly more dilated tube, containing active embryos.

The vagina merges imperceptibly into a single uterine tube, the walls of which are thicker than elsewhere, and which traverses the whole length of the tapering portion (cephalic) of the worm, 20 mm., as well as a portion of the body proper up to a point about 40 mm. from the mouth. The contents of this tube are mature embryos whose shells have been cast.

At this juncture the uterine canal swells slightly in size, and divides into two separate tubes, each of which again divides into two, thus making four separate tubules altogether; the distance from the bifurcation of the single tube to the point where these four tubules are formed is 20 mm. These four tubules are much larger than the parent tube, and quite four times as broad.

The ovarian tubes are twisted round one another in a spiral manner, enclosing amongst them at places the brown coloured intestine, which can be seen even through the undissected cuticle of the worm—they extend over practically the whole length of the worm, and terminate blindly within a few mm. of the tail. In the adult female worm these ovarian tubes are always engorged with ova in different stages of development, that is, advancing forwards from the tail, one finds that simple cells at the distal extremity become encapsuled cells further on, encapsuled young embryos still further, and, in the single uterine tube, free embryos with the shells cast off. The total length of each of these ovarian tubes is not easy to determine, but it cannot approximate to less than twice the length of the worm, for not only are the tubes twisted but are at places bent on themselves, thus occupying the body cavity to better advantage.

Ova and Embryos.

In all the young embryos of fertilised ova, a thin capsule completely envelops the contents. This capsule is oval and sometimes possesses a pointed spicule at one extremity, more often one at both extremities. The free embryos are found scattered in varying numbers inside the aortic tumours. When living, the embryos are extremely active and wriggle out of the genital opening, sometimes tail and at other times head first. Outside they struggle in the surrounding

media, coiling and uncoiling themselves after the manner of the common earth-worm when irritated by pressure.

No special parts or organs can be detected. When fresh the whole embryo appears as a refractile, granular mass of living substance. Even under high powers of the microscope, no œsophagus or any definite structure can be made out beyond refractile granules of various sizes, which are not blackened by osmic acid, and hence cannot be fat globules. The length of the embryo is ·29 to ·32 mm. and the breadth 3·5 to 4 mm.

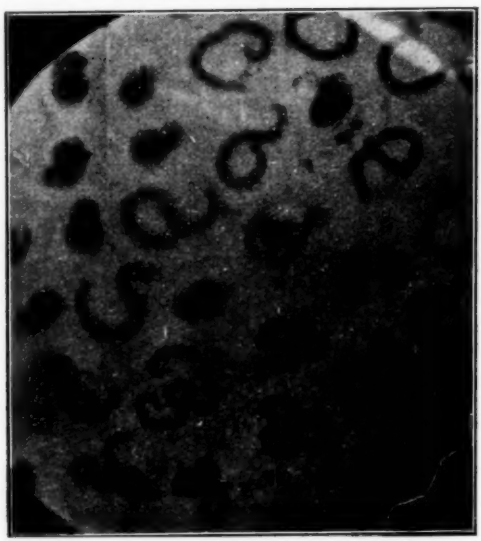

FIG. 4.—Embryos, magnified.

AORTIC WORM (MALE).

Alimentary Canal.—Mouth surrounded by an oral ring, œsophagus not so retractile, and shorter—only about ·6 mm. in length—than in the female. The intestine is scarcely ever brown in colour and does not contain blood; it is straight, there being no distended coils of the testis to displace it, and it ends in a cloaca in conjunction with the vas deferens. The anus merged into the cloaca is subterminal, and distant about ·15 mm. from the extremity of tail. Its details cannot be distinctly made out, being largely hidden away by the thick spicule and its sheath. Nothing definite can be made of the excretory or nervous apparatus.

Genital System.—The testis is a long narrow organ running parallel to the intestine. Above, it reaches to about the middle of the body, downwards, it terminates in a vas deferens which differs in no way from the testis, beyond the fact that it is hollow and slightly narrower. Within the testis a large number of spermatozoa may be seen. The vas deferens is continued as a stiff spicule which is very retractile.

This, the anterior spicule, measures ·22 mm. in length, and in the living state may be seen to project in and out by means of the strong muscles attached to it. Lying usually behind it, but occasionally by its side, is a short structure of a similar shape; this, the posterior spicule (or sheath of the penis), measures ·12 mm. This spicule is apparently not connected with the vas deferens. It is independently movable, but not so actively so as the anterior spicule (penis proper). The anterior spicule is a trumpet-shaped organ; where it is continuous with the vas deferens it is irregularly funnel-shaped, the diameter being just under ·03 mm. (30 microns). As it proceeds outwards, it tapers gradually until it finally ends in a slightly bulbous projection, and then a sharply defined filament. The cuticle round the point of emergence of the two spicules is raised, forming a prominent ring. The hinder portion of the worm

FIG. 5.—Tail of male worm, showing spicule.

is curved on its ventral surface, along which a distinct groove may be seen running longitudinally in the centre to admit of the passage of the spicules.

It will be seen that the arrangement of the genital organs in the male and female worms described above is best adapted amidst their surroundings for their several functions. The openings of both are situated inside the aortic tumour, the female in the constricted portion close to the mouth, and that of the male at the posterior extremity close to the tail, but well within reach of the female. Copulation takes place inside the tumour, and the produced embryos are also discharged into it, to be distributed later on to some unknown parts.

Spermatozoa.—The sperm cells produced by the testis are oval, spindle or cross-shaped in appearance, their largest diameter is 10 to 12 mm., each possesses an intensely refractile nucleus surrounded by granular protoplasm. The cells may change their shape from one form to another; when mature they pass down the straight vas deferens to be ejected through the narrow aperture in the anterior spicule.

Under the microscope, during the ejection of these cells, they are noticed to come out in strings, being attached to one another by means of some sticky substance, and often appear as a bunch of grapes hanging on to the ventral surface of the tail. No cilia or appendages of any sort have been seen.

Fate of the Embryos.

What becomes of the mature embryos which are discharged by the female worm into the interior of the tumour, is a question I am unfortunately not able to answer. That they must eventually find their way into the blood stream seems inevitable, but although myself and some one or two other observers have examined the blood of buffaloes we have never yet found an embryo in it.

There can be no doubt that several thousands of embryos are produced in each aorta containing these worms, and, as I have before stated, every buffalo examined either had the worms or showed place where they had previously been. Also it is, I think, improbable the tumour could possibly contain all the embryos produced by one worm, as some tumours may contain few embryos, although the worm will show many within her uterus, a fact that would lead one naturally to suppose that they have found their way out into the blood stream through the small hole at the base of the tumour. There is nothing to prevent them doing this, as they are very active in their movements when outside the body of the tumour.

That these parasites require another host for part of their life cycle there can also be no doubt, as, if this were not so, and the embryos could develop into mature worms in the body of the buffalo, which is undoubtedly the ultimate host, then one would naturally expect to find thousands of mature parasites developing in each aorta instead of the usual two to five.

The intermediate host is at present only a matter of conjecture, as in the face of being unable to find any embryos in the circulating blood, the further investigation is exceedingly difficult and somewhat obscure, although most interesting. It will, I think, probably be found to be some invertebrate animal, most probably a leech. Several species of leeches are found in the Eastern jungles, one known as the buffalo leech (or lintah of the Malays), a very large variety measuring, when distended with blood, some 4 to 5 inches long and 1½ inches thick, is often found in the jungle streams and paddy fields, and I have frequently seen as many as four or five attached to one buffalo. Although I have not yet been able to obtain any of these leeches for microscopical examination of their abdominal contents, I think it is in this direction future investigations should be carried on, and may yield good results. Nearly all the specimens of aortas with worms have been found in imported buffaloes killed for food in the slaughter house, and these, of course, being more or less confined, have no leeches on them. Buffaloes examined in the country districts of Selangor, Negri Sembilan, and Pahang, were found to contain the same worms in their aortas, and in these cases the animals were either dead of, or destroyed while suffering from, rinderpest. I do not think the intermediate host can be a tick of any sort, as ticks are very rarely found on buffaloes, and when they are present it is always on an extremely emaciated animal, while, on the contrary, worms or their markings are found in practically every buffalo.

The louse found constantly on the buffalo is also an improbable intermediate host, as although they have long probosces they appear to live on the skin *débris*, and are not blood suckers. Flies and mosquitoes, the only other possible intermediate hosts, have a very small chance of playing any part in the life cycle of these parasites, as the buffalo spends much of his time in mud or water, where flies or mosquitoes could not bite him anywhere except on the head, ears and face, and I think a buffalo's skin is too thick in these positions to be pierced by any of the blood-sucking flies, while the constant movement of the ears effectually prevents any of these insects from settling.

A question that would naturally suggest itself is, whether these parasites cause any harm to the host. Apparently they do not, but at the same time they must cause a certain amount of loss to the blood, especially when they are present in any numbers, say ten, twelve, or more. They would also cause some obstruction to the circulation, although this is certainly not apparent in the live animal.

Fate of the Mature Worm.

When the parasites die they shrink up and become converted into a firm, white, fibrous cord which is attached here and there to the aorta. When there are several of these cords they frequently intertwine with one another, and every stage in the degeneration of the parasite can be traced, from the recently dead worm, represented by a thick, firm, white cord attached at various places to the vessel, to a very thin cord more or less in fragments.

Degeneration of the Tumour and Changes in the Aorta.

The tumour undergoes degeneration, and the place occupied by it is represented by a dense, white, circular-shaped, corrugated scar, composed of fibrous tissue, and one frequently finds the cords representing the dead worms still attached to the posterior edge of the scar. Small aneurisms are frequently found in the aorta. These are caused by the loss of elastic tissue in the wall of the vessel; they are always found at the spot where a tumour has recently undergone degeneration. An aorta which has had many of these worms attached to it, presents a most characteristic appearance with its circular corrugated scars, small aneurisms, and increased thickness. It feels almost like tendon. Its internal surface is very rough and uneven, while it frequently happens that other worms are found embedded beneath the tunica intima. These belong to another species, and are seen as thin, wavy or serpentine-like tracks, yellowish or greyish in colour.

BURSÆ AND SHEATHS OF THE HORSE.

BY J. F. CRAIG, M.A., M.R.C.V.S., PROFESSOR OF ANATOMY AT THE ROYAL VETERINARY COLLEGE OF IRELAND, DUBLIN.

I. SYNOVIAL BURSÆ AND SHEATHS.

Synovial membranes are arranged as closed sacs at certain parts of the body to facilitate the movements of muscles, tendons, or ligaments. They are either simple in their arrangement (bursæ), and placed between tendons or ligaments, and osseous, cartilaginous or hard pro-

minences over which they pass, or present an arrangement similar to a serous membrane (sheaths or thecæ). These latter are developed in the neighbourhood of joints in connection with tendons; one portion of the synovial membrane of the sheath lines the tendon, the other the neighbouring structures, which form a sort of canal for its accommodation, and the two portions are continuous at some point on the tendon.

The synovial membrane of tendons and sheaths is identical with that of a diathrodial joint. It is a very fine, smooth and glistening connective tissue layer. It is provided with an incomplete layer of endothelium, and clusters of cubical cells are scattered over its surface. The cavity enclosed by the membrane has no direct communication with lymphatic vessels. Where it does not line bone, tendon, or ligament it is covered

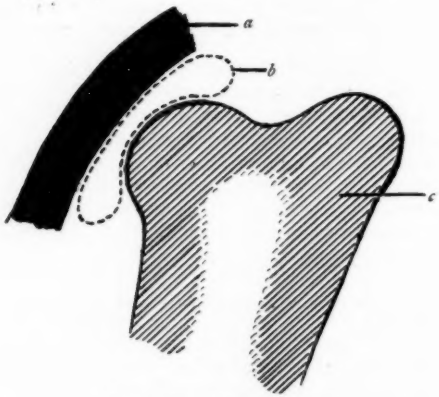

FIG. 1.—BURSA (*diagrammatic.*)

a, Tendon.
b, Synovial membrane of bursa.
c, Bone.

with small papillæ, which are richly supplied with blood. It secretes synovia, a glairy, straw-coloured fluid in small quantity, to lubricate the free surface in order to facilitate gliding movements of the tendons or ligaments. This fluid contains not only albumen, but mucin. The bones over the areas provided with these bursæ or sheaths are usually covered with a layer of fibro-cartilage, *e.g.*, convexity of great trochanter; in some instances ligaments are also thickened and strengthened, *e.g.*, the posterior tibio-tarsal and tarso-metatarsal ligaments in connection with the tarsal sheath; and the tendon itself increases in thickness and density, and becomes fibro-cartilaginous, especially near the periphery, *e.g.*, biceps tendon over the bicipital groove and the flexor perforans at the great sesamoid sheath. Tendon sheaths have no communication with neighbouring joints. Sometimes, however, tendons and muscles are covered by prolongations of the synovial membranes of the joints near which they lie. Thus, the synovial membrane of the elbow joint clothes the anterior face of the flexor muscles of the digit and the external flexor of the metacarpus for

a distance of 2 or 3 inches below the upper extremity of the radius; the outer synovial membrane of the femoro-tibial joint is prolonged downwards beneath the extensor pedis and tendinous portion of the flexor metatarsi for a distance of 3 or 4 inches in front of the fleshy portion of the latter muscle and the tibia. These prolongations should be noted in the description of the joints. Some of these synovial bursæ and sheaths are of very great surgical importance. They are frequently the subject of injuries, and are sometimes opened in accidental wounds. When a bursa or sheath is opened, the discharge is

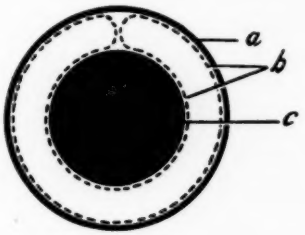

FIG. 2.

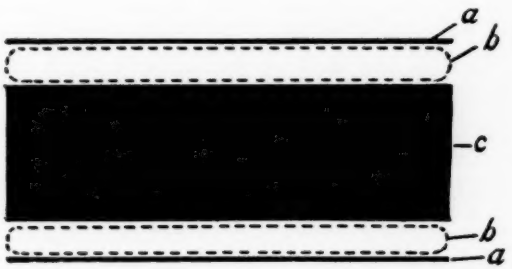

FIG. 3.

FIGS. 2 and 3.—TRANSVERSE AND LONGITUDINAL SECTIONS OF SYNOVIAL SHEATHS RESPECTIVELY (*diagrammatic*).

a, Structures surrounding the sheath.
b, Synovial membrane.
c, Tendon.

similar to that from a joint, but the condition is not so serious, and one ought to be able to distinguish them. The position and relationships of the bursæ and sheaths of the body should, therefore, be carefully noted.

SYNOVIAL BURSÆ AND SHEATHS OF THE FORELIMB.

SHOULDER.

Bursa of the Coracohumeralis, about 1½ inches in diameter, lying between the tendons of the coracohumeralis and subscapularis, deeply placed on the inner side of the shoulder joint.

Bursa of the Subscapularis, about 1 inch broad, interposed between the internal tuberosity of the humerus and the tendon of the sub-

scapularis, nearer to the shoulder joint than the preceding. These two latter bursæ are not of much practical importance.

Biceps Bursa (bursa intertubercularis) is very large. It lies at the point of the shoulder, between the tendon of origin of the biceps and the bicipital groove of the humerus. The mastoidohumeralis covers the bursa in front and on the outerside, and the insertion of the posterior deep pectoral muscle protects it on its inner aspect. In the living animal it is most easily opened on the outer side behind the biceps, but even then it lies about 1 inch under the surface of the skin. It can easily be located by taking the summit of the external tuberosity and the external tubercle of the humerus as guidelines. There should be no difficulty in making out these portions of the humerus in the living animal. The biceps bursa lies immediately in front of a line drawn between these two points. It extends downwards for about 2 inches below the summit of the external tuberosity and upwards for about 3 inches above it. It is about 3 inches broad, and is slightly supported at the sides by thin fascia, which retains the biceps tendon in the bicipital groove. The tendon is very hard and fibro-cartilaginous, and is moulded over the groove. This bursa in the horse has no communication with the shoulder joint. It lies about ½ inch in front of the capsular ligament, and is separated from it by a pad of fat. The biceps bursa is frequently affected in injuries to the point of the shoulder (bursitis), and is occasionally opened in accidental wounds over the region.

Bursa of the Infraspinatus, about 1½ inches in diameter; it lies between the outer tendon of the infraspinatus and the convexity of the external tuberosity of the humerus. This tendon is about ½ inch thick, and the bursa is well protected at the sides. It is covered by a thin portion of the mastoidohumeralis. It can easily be located in the living animal over the convexity of the external tuberosity.

Elbow.

Bursa of the Caput Magnum is only about ¾ of an inch in diameter, deeply placed between the forepart of the olecranon process of the ulna at its upper extremity and the tendon of insertion of the caput magnum immediately behind the caput medium.

Carpus.

Carpal Sheath.—This important theca is placed at the back of the carpus. It is about 10 inches long in the average-sized animal. It extends upwards above the level of the tuberosities at the lower extremity of the radius for a distance of about 3 inches, and downwards to the middle of the metacarpus, to the junction of the check or subcarpal ligament with the flexor perforans tendon, about 3 inches above the button of the splint bone. Its anterior boundary is formed by the lower extremity of the radius above, the posterior common ligament at the carpus, and below the carpus by the subcarpal ligament. Its outer boundary is formed by the pisiform bone. A strong, fibrous membrane supports it posteriorly. This membrane is attached on its outer side to the posterior border of the pisiform bone, and on its inner side to the internal lateral ligament of the carpus and the fascia over the front of the knee. Above, it is continuous with the fascia at the back of the forearm, and below the carpus it becomes very thin, and

fused with the very thin fascia of the metacarpus. This membrane lies immediately under the skin. On, or partly behind the latter, the smaller metacarpal artery descends vertically behind the internal metacarpal vein, about 1 to 1¼ inches to the inner side of the pisiform bone, from about 2 inches above the lower extremity of the radius to 3 inches below it, near the lower end of the carpus. There the small metacarpal artery sinks to the inner side of the flexor tendons to assist in the formation of the infracarpal arch. The external metacarpal vein, the external plantar nerve and a small artery, a branch of the supracarpal arch, lie in company to the inner side of the posterior border of the pisiform, outside the sheath. The vein is posterior, the nerve in the middle and the artery in front. The external plantar nerve is formed near the upper border of the pisiform by the junction of the ulnar with a branch of the median. Above the latter bone it becomes a vein of origin of the posterior radial, and is connected with the internal metacarpal vein or its continuation, the median, by a small transverse vessel. The structures which pass through the sheath are the flexor perforans and the flex or perforatus tendons, the large metacarpal artery, and the internal plantar nerve. Along the hinder border of the flexor perforatus the parietal and visceral layers of the sheath become continuous. Below the carpus the latter tendon lies directly behind the sheath. The large metacarpal artery descends in the sheath along the inner side of the flexor perforans tendon, about ¾-inch in front of the posterior border of the pisiform, and the internal plantar nerve here lies in front of it. The nerve joins the hinder border of the artery below the carpus. This sheath is sometimes opened in accidental wounds, and sometimes distended with fluid as the result of inflammation, acute or chronic. Because the sheath is least protected above and below the carpus it bulges out, especially laterally above the knee, and also shows enlargement below the carpus.

Synovial sheath of the Flexor Metacarpi Internus is placed in front of the carpal-sheath, and encloses the tendon of insertion of the flexor metacarpi internus. It lies partly in the posterior common ligament of the carpus, and about ½ inch to the inner side of the internal tuberosity at the lower end of the radius. It is about 5 inches in length in the average animal, and extends upwards for two inches above the lower extremity of the radius, and downwards to the head of the internal small metacarpal bone.

Synovial Sheath of the Outer Tendon of the Flexor Metacarpi Externus is about ½ inch broad, and begins above about 1½ inches behind the external tuberosity at the lower extremity of the radius. It extends downwards and forwards in the groove on the outer side of the pisiform bone, towards the head of the splint bone, and in a layer of subcutaneous fascia about ¼ inch thick. The sheath is about 2 inches long in the average-sized animal, and its lower extremity lies about 1½ inches below the lower extremity of radius.

Synovial Sheath of the Extensor Suffraginis is a very narrow theca, lying on the outer side of the carpus. Commencing about ¾ inch above the lower extremity of the radius it descends through the external lateral ligament of the carpus, and ends over the head of the outer splint bone. It is about 4½ inches long. It is not well protected above the carpus, but below the carpus it is covered by the carpal band, which joins the tendon of the extensor suffraginis. Therefore, when the sheath is swollen, it is most prominent on the forearm.

Synovial Sheath of Extensor Metacarpi Obliquus. The theca for the passage of the latter muscle over the carpus begins over the extensor metacarpi magnus in front of the carpus, about 2 inches to the inner side of, and on a level with, the internal tuberosity, at the lower end of the radius. Thence it is directed downwards and inwards in the innermost, the oblique, groove in front of the radius and over the anterior common ligament of the carpus, to end about 2 inches below the lower extremity of the radius. It is protected under the skin by a strong fibrous membrane which covers the front of the carpus, the annular band, at its upper extremity. It is in contact with the synovial sheath of the extensor metacarpi magnus. Its length in the average-sized animal is about 4 inches.

Synovial Sheath of the Extensor Metacarpi Magnus. The sheath to facilitate the movements of the latter muscle over the carpus, is the largest of the sheaths in the front of the knee. In the average-sized animal it is about 1¼ inches wide and 6½ inches long. It extends from about 4½ inches above the lower extremity of the radius vertically downwards over the inner of the two vertical grooves at the lower end of that bone. Opposite the internal tuberosity of the radius it is crossed superficially by the extensor metacarpi obliquus. It passes over the anterior common ligament of the carpus, and ends about 2 inches below the level of the external tuberosity of the radius. It lies about 2 inches in front of the latter tuberosity. Over the carpus it is protected by the annular band. On the radius it is unprotected, and here is distended when fluid accumulates within the sheath. This sheath is most commonly opened in broken knees.

Synovial Sheath of the Extensor Pedis lines the tendon of the latter muscle in front of the carpus. It is about 7 inches long. It begins about 3 inches above the external tuberosity of the radius, and descends in the outer of the two vertical grooves on the anterior face of that bone, about 1 inch to the inner side of the internal tuberosity of the anterior ligament of the carpus. It ends in front of the head of the large metacarpal bone, about 4 to 4½ inches below the lower extremity of the radius. It is protected in front of the carpus by the annular band, but above and below the knee it is not supported. At these two points it swells out in distension of the sheath. This sheath is sometimes opened in broken knees.

Fetlock.

Bursa of Extensor Pedis is a small synovial sac formed between the extensor pedis tendon and the anterior ligament of the fetlock joint in front of the lower end of the large metacarpal bone. It is formed on a level with the most prominent part of the fetlock joint. It is about ¾ inch wide and 1½ inches long in the average-sized animal. This bursa is occasionally distended with fluid so as to appear like a small ball under the tendon.

Bursa of Extensor Suffraginis is similar to that of the extensor pedis, and is placed on the same level to the outer side of it between the extensor suffraginis tendon and the anterior ligament of the fetlock joint. It is about 1 inch long and ½ inch wide.

Great Sesamoid or Metacarpo-phalangeal Sheath is a very large synovial apparatus enclosing the flexor perforans tendon behind the fetlock and pastern. It also covers the ring of the flexor perforatus tendon which

is formed behind the fetlock for the passage of the flexor perforans. It extends from about 1 inch above the button of the splint bone downwards to the hollow of the heel, the middle of the os coronæ. The average length of the sheath is about 6 inches. The synovial membrane lines posteriorly the flexor perforatus tendon, and below the fetlock the reinforcing sheath of the flexor perforans. Beneath the middle of the pastern the sheath lies only about ¼ of an inch from the surface, being there protected only by the thin reinforcing sheath and the skin. It is protected in front by the two branches of the suspensory ligament, the posterior surfaces of the sesamoid bones, the intersesamoidean ligament, the inferior sesamoid ligament and the posterior surface of the os coronæ. About the middle of the latter bone it is separated by a very thin, elastic septum from the navicular bursa, and is in contact in front with the synovial membrane of the coronopedal joint. At the sides it is only protected by the attachments of the reinforcing sheath of the flexor perforans to the sesamoid bones and to the suffraginis, and by the insertion of the flexor perforatus into the upper portion of the os coronæ. When the sheath is distended with fluid it may bulge out at three points, forming windgalls at the sides—(1) for about 1 inch below the level of the button of the splint bone (here the swelling may even pass behind the flexor perforatus tendon), (2) below the most prominent point of the fetlock between the attachments of the reinforcing sheath of the flexor perforans, to the side of the sesamoid bones and to the os suffraginis, and (3) beneath the middle of the first phalanx between the latter attachment and the insertion of the flexor perforatus. The windgall of the great sesamoid sheath above the fetlock is always distinguished from a distension of the synovial membrane of the fetlock joint by its position; it lies behind the suspensory ligament. This sheath is always separated by a distance of 2 or 3 inches from the lower extremity of the carpal sheath. The flexor tendons for that extent above 1 inch over the button of the splint bone are not lined by any synovial sheath or bursa.

Foot.

Navicular Bursa or Small Sesamoid Sheath, is a synovial sac which facilitates the movements of the flexor perforans tendon under the navicular bone. It lines the upper face of the tendon and the tendinous or lower surface of the navicular bone, and the interosseus ligament between the latter bone and the os pedis. Posteriorly it is separated only by a very thin elastic membrane from the lower extremity of the great sesamoid sheath, and above the navicular bone it is in contact with the synovial membrane of the coronopedal joint. From the lateral cartilages it is separated by an elastic band, which attaches the base of the plantar cushion to the side of the os coronæ, and by the digital vessels. In the average-sized animal the navicular bursa is about 1½ inches long and 2½ inches broad. It lies above the middle third of the frog, and about 1 to 1½ inches deep. To open into it from the plantar surface of the foot, the horny frog, plantar cushion, reinforcing sheath of the flexor perforans and the tendon of the latter muscle must be penetrated. The tendon itself is from ¼ to ⅜ inch thick. This bursa is sometimes opened by picked up nails, and is affected in navicular disease.

Synovial Bursæ and Sheaths of the Hind Limb.

Hip.

Bursa of the Middle Gluteus is a large synovial sac which intervenes between the tendon of the insertion of the middle gluteus muscle and the convexity of the great trochanter of the femur. The tendon is inserted into the crest. The bursa is about 3 inches wide by 2 inches long, and is about 1½ to 2 inches from the surface. It is covered by the biceps femoris as well as the middle gluteus. Its position can easily be ascertained by locating the great trochanter of the femur. The latter lies under the most prominent point in the living animal between the external angle of the ilium and the tuber ischii. This bursa is frequently injured in broad side falls, and is inflamed in false hip-joint disease.

Stifle.

Bursa of the Biceps Femoris is only about ½ inch broad, and lies between the thin tendon of the biceps femoris and the outer edge of the patella. It is only ½ or ¾ inch deep.

Bursa of the Anterior Straight Ligament of the Patella.—This bursa is developed in the groove on the anterior tuberosity of the tibia behind the anterior straight ligament of the patella. It is about 1 inch long. Its position can easily be ascertained in the living animal by manipulating the above-mentioned prominence.

Tarsus.

Sheath of the Extensor Pedis is a synovial theca which is placed at its upper extremity, about 1 inch in front of the external malleolus of the tibia, and descends in front of the flexor metatarsi, about 1 inch in front of the external lip of the pulley-like anterior surface of the astragalus, and under the three annular bands of the tarsus. It ends about 1 inch below the inferior annular band. It is about 4 inches long, and lies about ⅛ inch under the skin.

Sheath of the Flexor Metatarsi is formed in front of the tarsus between the tendinous and fleshy portions of the flexor metatarsi. Its upper limit lies opposite the internal malleolus of the tibia, and it descends for about 2 inches to the bifurcation of the fleshy portion of the above muscle. It is protected anteriorly by the superficial portion of the flexor metatarsi, and the two upper annular bands of the tarsus. It is placed to the inner side of the sheath of the extensor pedis tendon.

Bursa of the Cunean Tendon assists the movement of the cunean tendon of the flexor metatarsi over the internal lateral and astragalo-metatarsal ligaments of the tarsus. The bursa is about ¾ inch in its vertical and 2 inches in its antero-posterior diameter. It extends backwards under the tendon from a vertical line drawn downwards from the forepart of the internal malleolus of the tibia. Above and below the tendon the bursa is only covered by skin and thin fascia. This bursa is opened in cunean tenotomy.

Sheath of the Peroneus Tendon is very narrow and long. It begins about 1½ inches above the external malleolus of the tibia and extends downwards in a groove in the latter prominence through the external lateral ligament of the tarsus and under the inferior annular band. It lines the peroneus tendon for 1 inch below the band, and here it is subcutaneous. The length of the sheath is about 6½ inches in the average-

sized animal. It is sometimes distended with fluid, and this distension is chiefly marked at its upper and lower extremities.

Bursa of the Flexor Perforatus.—This sac is about 5½ inches long and 1 inch broad, and extends for about 3 inches above the tuber calcis. It is bounded behind by the flexor perforatus, which is about ⅜ inch thick, and in front by the tuber calcis and gastrocnemius tendon. At the sides it is supported over the os calcis by the slips of the flexor perforatus, but above the tuber calcis the synovial membrane of the bursa is separated from the skin by only a thin layer of fascia. This bursa is distended with fluid in deep-capped hock, and then bulges out at the sides of the point of the hock.

Bursa of the Gastrocnemius is about ½ to ¾ inch in diameter and lies in front of the above-mentioned bursa between the gastrocnemius tendon and the forepart of the upper extremity of the tuber calcis.

Sheath of the Flexor Accessorius is very narrow and about 6½ inches long, placed towards the back of the hock. It extends from 3 inches above the internal malleolus of the tibia to 3½ inches below it. It lies 1½ inches behind that prominence and 2½ inches in front of the point of the hock, and to the inner side of the tarsal sheath. It is covered by skin and thick fascia.

Tarsal Sheath lies at the back of the tarsus. It is very broad and extends from about 1 inch above the level of the point of the hock downwards to the upper third of the metatarsus. Its length in the average animal is about 8 inches, and its breadth from 1 to 1½ inches. The flexor perforans tendon passes through it. It is bounded in front by the lower extremity of the tibia, the posterior tibio-tarsal, tarso-metatarsal and subtarsal ligaments. The inner surface of the os and tuber calcis forms the outer wall of the sheath. The synovial membrane passes from the posterior aspect of the flexor perforans tendon on to the fibrous membrane which forms the posterior boundary of the tarsal sheath. This fibrous membrane lies immediately under the skin and stretches from the calcaneo-cuboid ligament and posterior border of the tuber calcis inwards, to fuse with the fascia and the internal lateral ligament on the inner side of the hock. It is continuous above with the deep fascia of the leg, and below it thins away and joins the fascia of metatarsus. The planter nerves and arteries and the external metatarsal vein are placed between this fibrous membrane and the synovial membrane of the sheath. The terminal portion of the posterior tibial nerve is arranged on the postero-internal aspect of the sheath and reaches as far down as a point nearly opposite to the internal malleolus of the tibia. There it divides into the two plantar nerves. The posterior tibial artery is in close contact with the nerve over the above area, and it terminates in the two plantar arteries. The internal plantar nerve and artery descend along the inner side of the sheath, and the external plantar nerve and artery and external metatarsal vein are placed to the outer side and along the inner aspect of the calcaneo-metatarsal ligament. The lower extremity of the sheath is situated near the junction of the flexor accessorius with the flexor perforans, and here the sheaths of the two tendons are in contact. There is a distance of about 4 inches between the tarsal and great sesamoid sheaths. Over this area the flexor tendons are not provided with synovial membrane. The tarsal sheath lies only about ¼ to ½ inch under the surface. The sheath is affected in tendinous thorough-

pin. Then it is distended with fluid. The swelling chiefly occurs to the inner side of the os calcis, and especially near the upper extremity of the sheath where it is not so well supported. It is distinguished from articular thoroughpin by its position, and also because it is not accompanied by a bog-spavin.

Fetlock.

Bursa of the Extensor Pedis.—This sac occurs in the same position as in the fore-limb in front of the anterior ligament of the fetlock and lower extremity of the large metatarsal bone behind the fetlock. It lies near the middle line of the leg. It is about $\frac{3}{4}$ inch broad. The tendon over it is about $\frac{1}{4}$ or $\frac{3}{8}$ inch thick. This bursa, which is sometimes opened in accidents, and is occasionally distended with fluid, appears like a small ball behind the extensor pedis tendon.

The *great sesamoid sheath* and the *navicular bursa* are arranged as in the fore-limb.

Synovial Bursa of the Head.

Bursa of the Tensor Palati is a very small synovial sac formed for the passage of the tensor palati round the outer side of the hamula process of the pterygoid bone.

II. MUCOUS BURSÆ OF THE BODY.

These are sacs which are formed after birth, usually between the skin or ligament and bony prominences. They are inconstant in position in many cases, are only occasionally found, and are best seen in old animals. They are developed by the movement of the skin or ligament causing a rupture of the connective tissue attaching it to neighbouring underlying structures. This movement leads further to a smooth condition of the surfaces of the skin or ligament on the one hand, and the neighbouring prominences on the other, at the point of rupture. Frequently the sacs so formed are not simple but irregular in shape, and consist of several compartments. They are sometimes distended with fluid and hygromata form in connection with them as the result of injury, *e.g.*, capped elbow. The fluid formed in them is identical with a serous fluid.

Mucous Bursæ of the Fore-limb.

Subcutaneous Bursa at the Point of the Elbow.—Only sometimes present and varies in breadth from 1 to 2 or 3 inches. It is formed between the skin and the back of the olecranon process of the ulna. It is frequently multilocular. It is affected, as the result of bruising, with hygroma of the elbow and elbow tumour.

Subcutaneous Bursa in Front of the Carpus has been described as occurring between the skin and fascia over the carpus. I have not yet seen the condition.

Mucous Bursæ of the Hind-Limb.

Subcutaneous Bursa over the External Angle of the Ileum is very variable in size, and only found in some old horses. It consists of 2 or 3 small cavities, usually having a communication with one another, and found between the skin and the extremities of the angle of the haunch.

Subcutaneous Bursa of the Tuber Ischii is a small sac about 1 inch in diameter, sometimes developed between the skin and semitendi-

nosus muscle over the tuber ischii. It is sometimes inflamed and distended with fluid.

Prepatellar Bursa is about ½ to 1 inch in diameter from between the skin and the upper third of the patella, found frequently in old horses. It is affected occasionally in injuries (bursitis of the prepatella bursa).

Subcutaneous Bursa over the Point of the Hock is inconstant. It is oval in shape, and about 1½ inches long and ¾ inch broad. It is formed between the perforatus cap over the point of the hock and the over-lying skin, and facilitates the alteration in the arrangement of the skin during the movements of the tibio-tarsal joint. It lies on the level with the upper extremity of the tuber calcis. This bursa is affected in superficial capped hock.

MUCOUS BURSÆ OF THE HEAD, NECK AND TRUNK.

Bursa of the Funicular Portion of the Ligamentum Nuchæ is occasionally found in the old animal, between the funicular portion of the ligamentum nuchæ and the atlas, about 4 or 5 inches behind the occipital crest. It lies between the posterior straight muscles of the head and may be 3 inches long. It is affected in poll evil.

A Second Bursa has been described as being formed between the ligamentum nuchæ and the superior spinous process of the second cervical vertebra. This bursa is bounded at the sides by the complexus muscle.

Subcutaneous Bursa of the Withers has occasionally been noted as extending on the side of the withers from the fifth to the seventh dorsal vertebra. It is involved in fistulous withers.

I have not observed the two latter bursæ in any of my dissections.

Small Bursa over the top of the spines of the first, second and third dorsal vertebra under the ligamentum nuchæ are rarely developed. The tops of the spines are, in these cases, quite smooth. The bursæ are oval in shape, and may be 2 inches in diameter.

Clinical Articles.

A NEW SKIN-PARASITE (LOUSE) OF SHEEP.

BY J. A. GILRUTH. M.R.C.V.S.,* CHIEF VETERINARIAN AND BACTERIOLOGIST TO THE GOVERNMENT OF NEW ZEALAND.

A FEW years ago a number of specimens of a small parasite found on the skin of the face of sheep, were forwarded for my examination and opinion by a well-known sheep breeder in the South Island. Although these specimens were not well preserved, yet microscopical examination showed them to be the variety of lice known as *Hæmatopinus*.

Various members of this species are found, and have been described as affecting the different domestic animals, and even animals which are in a wild state, but so far no *Hæmatopinus* has been described as affecting the sheep.

The common sheep louse (*Trichodectes sphærocephalus*) presents many

* Reprinted from his Report for 1906.

well-marked differences in form and size to the parasites of the *Hæmatopinus* class, as will be readily observed by an examination of the accompanying illustration. The *Hæmatopinus* is much larger, and the long head with its conical extremity exhibits a marked difference to the broad rounded head of the *Trichodectes*. Many other variations between the two parasites can easily be observed under the microscope. The species *Hæmatopinus* is capable of effecting more injury to the sheep than the *Trichodectes*. The former possesses a mouth so formed as to enable it to penetrate the skin of the sheep and live upon its blood. The common louse appears to go no deeper than the outer skin, and consequently causes less irritation and less injury.

New sheep-louse (*Hæmatopinus sphærocephalus*), greatly magnified.

Mr. Kerrigan, who was requested to procure further specimens, reported that none could then be found, the animals having been dipped after the specimens were forwarded.

Subsequently Mr. Wilkie, late Government Veterinarian, made a careful examination of the flock in question and found a number of parasites, of which he made the accompanying drawing and described some of the important anatomical appearances. Unfortunately he could not secure any male specimens. His more careful observations proved my decision regarding the classification of the parasite to be correct.

The parasite is practically only found in spring to any extent, and is exclusively confined to the skin of the face, but is occasionally observed on the skin of the legs.

Mr. Wilkie, who took some specimens of these parasites with him to Europe, writes me that he has submitted them to Professor Neumann, the greatest living authority on parasites of the lower animals, who has written Mr. Wilkie to the following effect:—

"It appears to be without doubt a new species. It is closely allied to *Hæmatopinus vituli*, L. (*H. tenuirostris*, Burm.), which lives on the ox, especially the calf, but it is certainly distinct in several characters."

Attached is a reproduction of a drawing made by Mr. Wilkie, which gives a good idea of the parasite enlarged.

Professor Neumann has asked, through Mr. Wilkie, for a number of specimens in order that a complete description of its anatomy, &c., may be prepared.

Attention is drawn to the occurrence of this parasite in sheep, so that flockowners may communicate their experience, and also that we may secure the specimens asked for.

CASE OF PIROPLASMOSIS IN A PONY.

BY LIEUTENANT H. S. ALLEN, A.V.C., QUETTA, BALUCHISTAN.

THE animal, an 8-year-old Arab gelding, was suddenly taken ill on the polo ground on September 8, 1906. He began blowing and shivering, with patches of perspiration over the flanks, back and armpits. The pulse was slow, hard, and wiry, but the mucous membranes of the mouth and eyes normal in colour. A stimulant was given, a good rubbing down was ordered, with warm clothing, bran mash, green lucerne, and plenty of common salt. The next morning a saline laxative was given, and the pony appeared to be going on well. On September 12 there was a great change; he was very depressed, the mucous membranes were a deep orange colour, the urine very dark and fæces coated with mucus, the pulse quick and strong, respirations and temperature normal. An hepatic stimulant was given, and water *ad lib.*

September 13, temperature, 7 a.m., 101·2° F.; 6 p.m., 99° F. September 14, temperature, 7 a.m., 101·6° F.; 6 p.m., 101° F. The colour of the mucous membranes was darker, bowels very constipated, pain shown when passing fæces, the urine the colour of porter, frothing when falling on the ground. The pony refused food, rapidly falling away in condition.

September 16. There was disinclination to move, and signs of pain on pressure behind the last right rib; appetite very poor. Temperature, 7 a.m., 101·6° F.; 6 p.m., 102° F. Warm fomentations over region of liver.

September 17. Symptoms of peritonitis, great depression; temperature, 7 a.m., 103·2° F.; 6 p.m., 102·2 F°.

Blood smears showed *Pyrosoma equi*, with very few leucocytes present. The pony died at 2 a.m., September 18.

On *post-mortem* examination traces were found of old-standing pleurisy, peritonitis, and hepatitis. The liver was adherent to the diaphragm, and weighed 15¼ lbs., spleen 7½ lbs., heart 9¼ lbs. Both the spleen and liver were cirrhotic in consistency, the heart showed signs of fatty degeneration. Both lungs were congested. The intestines, bladder, and kidneys appeared to be healthy.

The pony was said to have suffered from frequent attacks of "liver" during his life.

DEGENERATION OF THE SOLE, WITH DESCENT OF THE PEDAL BONE.

BY R. MACGREGOR, M.R.C.V.S., MARKET HARBOROUGH.

On July 24 I was called in to a black carriage gelding which had picked up a nail two days previously. He was in severe pain and blowing. The nail had penetrated the centre of the outside of the frog in the *near* hind and had gone very deep. I stripped that part of the frog but could find no pus, nor, indeed, was there anything but a thin watery discharge at any time.

After five days of the usual treatment, during which there was no perceptible improvement, three abscesses formed on the course of the extensor pedis tendon above the fetlock, the leg being swollen as far as the hock. I opened the abscesses and had the leg fomented four times daily in a weak solution of creolin, and gave quinine internally.

After this he seemed to improve, putting some weight on the leg.

On August 14, three *weeks* from start, I found him very lame on the *off* hind, putting all his weight on the hitherto lame foot. On examination I saw that there was descent of the pedal bone right through the sole, and the case being hopeless I ordered him to be shot.

Post-mortem.—(1) The near hind foot was practically all right; (2) the off hind was in an extraordinary state, the sole and frog were very thin and had undergone degenerative change, which had also extended to the laminæ of the wall.

The existence of such an extensive state of disease, which must have existed a considerable time, was a great surprise to me, though the groom knew that the horse had "thrush." I do not think it would have been possible, even by slinging, such was the state of the foot, to have prevented the pedal bone from descending.

Abstracts and Reports.

BOVINE IMMUNITY TO TUBERCULOSIS.

BY PROFESSORS DR. R. KCH, DR. W. SCHÜTZ, DR. F. NEUFELD AND DR. H. MIESSNER.

*From the Institute for Infectious Diseases in Berlin, and the Pathological Institute of the Veterinary High School in Berlin.**

I.

Many indications exist already of the possibility of rendering cattle immune to experimental infection with bovine tuberculosis. Nevertheless, no agreement exists as regards methods, nor as to the reliability of results. In the following pages are quoted the experimental results of a method of treatment which confers a high degree of immunity on cattle. On the other hand, it is shown that apparently slight differences in method suffice to render the results doubtful.

* Abstracted from the *Archiv. für Tierheilkunde*, vol. 31, 1905.

Of the various methods with which it has been sought to obtain immunity from bovine tuberculosis, there is no doubt the best results have been obtained with intravenous injections of living human tubercle bacilli. *We have employed this method from the commencement, and the results of our experiments have naturally demonstrated to us the difference which exists between the bacilli of human tuberculosis and of bovine tuberculosis. We are convinced that the problem of immunity to tuberculosis in the phase we have investigated, namely, the protective inoculation of healthy animals against fatal doses of virulent material, is most intimately associated with the question of the difference of the bacilli of human tuberculosis and the bacilli of bovine tuberculosis, and that this problem has entered upon a new stage since this suggested difference has been definitely proved by the experiments of Koch and Schütz.*

These experiments have shown that cattle can be inoculated without injury with large quantities of living bacilli of human tuberculosis, whilst after injection of even small quantities of living bacilli of bovine tuberculosis they contracted general tuberculosis. Hence came the suggestion of immunising cattle, which are only receptive of the virus of bovine tuberculosis, by preliminary treatment with the virus of bovine tuberculosis, and our experiments therefore are closely connected with the earlier trials of Koch and Schütz. In point of time our experiments on cattle are preceded by Neufeld's experiments (*Deutsche med. Wochenschrift*, 1903) on asses and goats, as with these animals the possibility was first established (in the autumn of 1901) of securing a reliable immunity against large doses of virulent bovine tubercle bacilli. A short time after, as already communicated by Neufeld (*Deutsche med. Wochenschrift*, 1904), we applied this method to cattle.

The injection of living bacilli of human tuberculosis is not the only method which has been tried to render cattle immune to bovine tuberculosis. Apart from the trials with passive immunisation, there may be mentioned: (1) The injection of the products of metabolic change from tubercle bacilli, as well as dead tubercle bacilli; (2) The injection of living bacilli of allied nature to tubercle bacilli (bacilli of avian tuberculosis, bacilli of tuberculosis of cold-blooded animals, and acid-resistant bacilli); and (3) The injection of attenuated bovine tuberculosis bacilli.

The authors review the results of these three methods obtained by—

M'Fadyean. "Experiments regarding the Immunisation of Cattle against Tuberculosis," *Journal of Comparative Pathology and Therapeutics*, 1901, p. 136, and 1902, p. 60.

Pearson and Gilliland. "Some Experiments upon the Immunisation of Cattle against Tuberculosis," *Journal of Comparative Medicine and Veterinary Archives*. Philadelphia, November, 1902.

Grancher and Ledoux-Lebard. "Studies on Experimental Tuberculosis in the Rabbit," *Arch. de Med. exp. et d'anat. path.*, 1891, 1 to 2.

Héricourt and Richet. "Tuberculous Vaccination in the Dog," *Le bull. med.*, 1892.

Grancher and Martin. "Studies in Tuberculous Vaccination," *Revue de la tuberculose*, 1893, p. 289.

Babes. "Essays on the Treatment of Tuberculosis (by Injection of the Blood of Dogs rendered Immune to the Malady)," a communication to the Congress for Tuberculosis, 1893.

Courmont and Dor. "Vaccination against avian or human tuberculosis with the soluble products of the avian tubercle bacilli," Congress for Tuberculosis, 1891.

Paterson. "A Method of Producing Immunity against Tuberculous Infection," the *Lancet*, 1897, p. 1106.

Koch. "On the Agglutinisation of the Tubercle Bacilli and its Utilisation," *Deutsche med. Wochenschrift*, 1901, No. 48.

Moeller. "On Active Immunisation against Tuberculosis," *Zeitschrift für Tuberkulose*, vol. 5, p. 206.

Klemperer. "On the Relation of Acid-resistant Saprophytes (Pseudo-tubercle bacilli) to Tubercle Bacilli," *Zeitschrift für klinische Medicin*, vol. xlviii., p. 250.

Friedmann. "Immunisation against Tuberculosis," *Deutsche med. Wochenschrift*, 1903, p. 953; 1904, pp. 166, 1,673.

Von Behring. "Tuberculosis," *Beiträge zur Experimentellen Therapie.*

Lorenz. "Bovine Tuberculosis and the Behring Immunisation Method," *Berl. thierarztl. Wochenschrift*, 1903, No. 48.

Schlegel. "On Protective Inoculation against Tuberculosis," *Berl. thierarztl. Wochenschrift*, 1903, No. 49.

Eber. "On the Resistance of T. B. Cattle to Injections of Bovine Virus," *Berl. thierarztl. Wochenschrift*, 1904, No. 53.

Hutyra. "Protection against Bovine Tuberculosis by Behring's Method," *Beiträge zur experimentellen Therapie.*

Further, Thomassen * has reported that by intravenous injection of bacilli of human tuberculosis he has produced a considerable degree of immunity against bovine tuberculosis in two calves. They showed only slight tuberculous changes in the lungs after test injections of bovine bacilli, whilst a control animal injected with the same quantity of bovine bacilli at the same time, died from general tuberculosis within nineteen days. A third animal was immunised by Thomassen by intraocular injection. This animal was free from tuberculosis.

A good result was obtained by Pearson and Gilliland † with two calves a year earlier. They inoculated intravenously two calves during a period of two months with increasing quantities of bacilli of human tuberculosis, together 0·16 grammes. After two months both animals, as well as two control calves, received an injection in the bronchial tubes of bovine tubercle bacilli. Two months subsequently all the calves were killed. *Post-mortem* examination showed the treated animals to be free from tuberculosis, whilst numerous infected areas were discovered in the lungs and many glands of the control animals.

Baumgarten,‡ by injection of bacilli of human tuberculosis subcutaneously into calves, attained so high a degree of immunity that they were protected against infection with bovine tubercle bacilli fatal to control animals. Baumgarten says: "A single subcutaneous inoculation with human tubercle bacilli suffices to establish this immunity against bovine tuberculosis." This immunity lasted two and a half

* "Immunisation of Calves against Tuberculosis," *Recueil de Médecine Vétérinaire*, 1903, p. 6.

† *Loc cit.*

‡ "Immunisation of Calves against Tuberculosis," *Berl. Klin. Wochenschrift*, 1904, No. 43.

years after the preventive inoculation "against every successive inoculation with bovine tubercle fatal to control animals." No further particulars are given by Baumgarten, who believed intravenous injections could be substituted by subcutaneous injections.

After writing this paper F. Klemperer published * some very noteworthy experiments which we would briefly refer to. He shows by one experiment that immunity in cattle can be produced by subcutaneous injection of human tubercle bacilli, and then devotes himself to the question whether in pre-existent bovine tuberculosis it is possible to establish a subsequent immunity or otherwise favourably influence the disease. In the animals selected by Klemperer for experiment the natural disease had already progressed too far, so that no improvement could be expected. On the other hand, in cattle artificially infected with tuberculosis, Klemperer observed a certain degree of favourable influence on the course of the disease by subsequent subcutaneous injections of human tubercle bacilli.

Of our own experiments only details of the later ones are given, in which the animals were exclusively treated with one or two intravenous injections.

Of the earlier trials the first successful immunity results have already been communicated by Neufeld (*Deutsche med. Wochenschrift*, 1904); these established the possibility of rendering cattle immune, but were not free from criticism and not indicative of the method, as the animals had for other purposes already received subcutaneous injection and repeated doses of tuberculin and dead tubercle bacilli. Gradually we came to a simpler and more reliable method of procedure, assisted by earlier experience on goats and asses, which had shown the possibility of obtaining a very high degree of immunity by one or two injections of living cultures of tubercle bacilli.

We succeeded in obtaining complete immunity of cattle with only two injections at first of an attenuated bovine tubercle bacillus culture (P. A.) of which we shall speak hereafter, in the following case:—

Calf 13 (weight, 157 kilos). August 25, 1902, culture P.A., 0·01 intravenous. October 17, 1902, culture P.A., 0·01 gme. intravenous. December 24, 1902, bovine tubercle, Culture xiv.,0·01 gme. intravenous. Killed August 11, 1903 (weight 274 kilos), healthy. Calf 14, served as control animal December 24, 1902. Culture 0·01 gme. intravenous. January 16, 1903, died, miliary tuberculosis of the lungs.

The calves to which the following reports relate, were treated in systematic manner with various tubercle cultures of human origin or with the above-mentioned attenuated bovine culture, and then all tested by intravenous injections of the same highly virulent bovine Culture xiv. as used in the above experiments. By these experiments it was sought to determine the questions how often and how large injections were necessary for immunisation, at what period immunity was developed, and whether differences were observable in the immunity conferred by human tubercle bacilli of different origin.

In the first place a large number of tubercle bacilli cultures from human subjects were obtained, thanks principally to Drs. Oestrich, Westenhoffer, and Friedmann. With this material guinea-pigs were

* "Experimental Contribution to the Tuberculosis Problem," *Zeitschrift für klin. Med.*, vol. lvi., Nos. 3 and 4.

No. of calves	Bacillus cultivation	Weight of calves. Kilos.	First injection	No. of days between first and second injection	Change in weight. Kilos.	Fever	Second injection	No. of days between second injection and control injection	Change in weight. Kilos.	Fever
1	Friedmann	163·5	30 days A 2 cg.	27	+ 3·5	××	28 days B 5 cg.	42	+ 11	×
2	,,	160·5	30 ,, A 1 cg.	27	− 4·5	××	28 ,, B 5 cg.	42	+ 5	−
3	432	148·5	40 ,, A 2 cg.	26	+ 7·5	××	32 ,, A 5 cg.	42	+ 26	×
4	482	204·5	40 ,, A 1 cg.	26	+17·5	×	32 ,, A 5 cg.	42	+ 19	×
5	486	157·5	29 ,, A 2 cg.	32	0	×××	31 ,, A 5 cg.	37	+ 8·5	×
6	486	118·5	29 ,, A 2 cg.	33	+ 2·5	×××	32 ,, B 5 cg.	36	+ 21	××
7	496	171	29 ,, A 2 cg.	34	− 2	×××	33 ,, A 5 cg.	93	+ 83·5	×
8	496	131·5	33 ,, A 1 cg.	30	+12·5	×××	33 ,, A 5 cg.	93	+ 61	×
9	492	161	41 ,, A 2 cg.	49	− 2	×××	14 ,, B 5 cg.	90	+ 73	×
10	492	140·5	41 ,, A 1 cg.	49	+28·5	××	14 ,, B 5 cg.	90	+ 54	××
11	Westenhöffer	150	43 ,, A 2 cg.	50	+10	×××	50 ,, B 5 cg.	90	+ 72	×
12	,,	146	43 ,, A 1 cg.	63	+ 5	××××	13 ,, B 5 cg.	88	+ 67	××
13	Augusta Hospital	154	47 ,, A 1 cg.	52	+28	××	24 ,, B 5 cg.	88	+ 67	×
14		132	14 ,, B 1 cg.	44	− 3	××	24 ,, B 5 cg.	88	+ 64	×
15	800	100	41 ,, A 2 cg.	54	+19	××	19 ,, A 5 cg.	91	+ 41	×
16	800	123	41 ,, A 1 cg.	54	+16·5	××	19 ,, A 5 cg.	91	+ 65·5	×
17	494	100	18 ,, A 2 cg.	39	−4	×××	31 ,, B 5 cg.	87	+ 60	×
18	494	120	18 ,, A 1 cg.	39	−21	××	31 ,, B 5 cg.	87	+ 82	×
21	482	114	30 ,, B 3 cg.	103	+43	×				
22	482	135	30 ,, B 2 cg.	103	+68	××				
23	482	107	30 ,, B 1 cg.	103	+41	××				
24	Attenuated PA	148	25 ,, B 2 cg.	169	+105	×××				
25		104	25 ,, B 1 cg.	169	+86	×××				
26	Bovine culture	146	25 ,, B 1 cg.	21	+19	××××	2·5 cg.	148	+ 95	×××

A and B = Glycerine-agar and glycerine-bouillon cultivations respectively, the preceding figure its age, and the following figure the number of centigrammes injected.
− = No fever.

inoculated subcutaneously and pure cultivations made from the spleen of the diseased animals. We used both cultivations on glycerine-agar and in glycerine bouillon, finally only the latter. For our experiments we used only four to six weeks old cultivations.

To determine the quantity of tubercle bacilli injected, a bouillon culture was filtered and the mass dried by pressing on bibulous paper with a platinum spatula until dry. The dry material was weighed on a fine balance, and triturated in an agate mortar with 0·8 per cent. sterile and filtered salt solution. The quantities used for intravenous injections were such as preliminary trials on asses, goats, and calves proved best. The tubercle bacilli were always injected into the jugular vein, between the upper and middle third of the neck, after the hair had been shaved off and the skin cleansed with alcohol.

At the first inoculation some of the calves received 0·01 gramme, others 0·02, in 5 or 10 cc. 0·8 per cent. salt solution; at the second inoculation all received 0·05 gramme. There was an interval of from one to two months between the first and second inoculations. Eighteen calves were first used, always two being inoculated with the same bacillus culture, the origin of which is given below:—

(1) Cultivation Friedman (Calves 1 and 2), from human tuberculous material. Growth very profuse. Guinea-pig infected died in one and a half months.

Control injection with bovine Culture XIV.	No. of days between control injection and death, or Dec. 10, 1904	Change in Weight. Kilos.	Fever	No. of calves	Total No. of days of experiment to death, or Dec. 10, 1904	Total change in weight. Kilos.	Fever after reaction from control injection	Day of death	*Post-mortem* examination.
36 days B 2 cg.	100	+ 61	××	1	169	+ 75·5	×	May 18, 1904	Healthy.
36 ,, B 2 cg.	96	+ 17·5	××	2	165	+ 18	××	,, 14, 1904	Tuberculosis of lungs.
36 ,, B 2 cg.	100	+ 80	××	3	168	+113·5	××	,, 18, 1904	Serous and renal tuberculosis.
36 ,, B 2 cg.	98	+ 36	××	4	166	+ 72·5	××	,, 16, 1905	,, ,, ,,
27 ,, B 2 cg.	100	+ 56	×	5	169	+ 64·5	×	,, 19, 1904	Healthy.
27 ,, B 2 cg.	30	+ 3	×××	6	99	+ 26·5	××××	Mar. 11, 1904	Miliary tuberculosis.
23 ,, B 2 cg.	246	+132·5	×	7	373	+214	–	Living	
23 ,, B 2 cg.	236	+192	×	8	359	+240·5	–	Nov. 30, 1904	Healthy.
27 ,, B 2 cg.	221	+ 98	×	9	360	+169	–	,, 30, 1904	,,
27 ,, B 2 cg.	221	+112	×	10	370	+194·5	–	Living	
19 ,, B 2 cg.	220	+123	×	11	360	+205	–	Living	
21 ,, B 2 cg.	209	+ 52	××	12	360	+124	–	Dec. 20, 1904	Healthy. [nut in lungs.
21 ,, B 2 cg.	209	– 14	××	13	349	+ 81	–	,, 20, 1904	Tuberculous patch size of hazel-
21 ,, B 2 cg.	209	+ 37	××	14	341	+ 98	–	,, 20, 1904	Healthy.
24 ,, B 2 cg.	194	+ 80	××	15	339	+140	××	,, 21, 1904	Tuberculous patches in lungs.
24 ,, B 2 cg.	194	+110	×	16	339	+192	–	Living	
24 ,, B 2 cg.	184	+ 88	×	17	310	+144	–	Nov. 30, 1904	Healthy.
24 ,, B 2 cg.	194	+ 81	×	18	320	+142	–	Living	
23 ,, B 2 cg.	117	+ 56	×	21	220	+ 59	–	Nov. 30, 1904	Pleuritis and peritonitis villosa.
23 ,, B 2 cg.	127	+ 79	××	22	230	+147	–	Dec. 21, 1904	Pleuritis villosa.
23 ,, B 2 cg.	119	+ 75	××	23	222	+116	–	,, 2, 1904	Healthy.
24 ,, B 2 cg.	91	+110	××	24	260	+215	–	Living	Pleuritis chronica villosa,
24 ,, B 2 cg.	91	+ 55	××	25	260	+141	–	Jan. 5, 1905	[bronchitis.
24 ,, B 2 cg.	91	+ 47	××	26	260	+161	–	Jan. 5, 1905	Bronchitis catarrhalis lobularis.

* × = very slight rise in temperature.
×× = slight rise in temperature.
××× = severe rise in temperature.
×××× = severe and long continued rise in temperature.

(2) Cultivation 482 (Calves 3 and 4), from human lung (No. 482 of 1903 section. Register of the Pathological Institute, Berlin).

(3) Cultivation 486 (Calves 5 and 6), from spleen of guinea-pig inoculated from part of tuberculous bronchial glands of man (Register No. 486).

(4) Cultivation 489 (Calves 7 and 8), from spleen of guinea-pig inoculated with human lung tissue (Register No. 489).

(5) Cultivation 492 (Calves 9 and 10), from the tuberculous lung of man (Register No. 492 of the Pathological Institute, Berlin University), with which three guinea-pigs were subcutaneously inoculated. Two animals died in one and a half, the third in two months. From the spleen of the first cultivations were made which grew vigorously.

(6) Cultivation Westenhoffer (Calves 11 and 12). From the tuberculous lung of a man, on whom *post-mortem* examination was made by Westenhoffer. Three inoculated guinea-pigs died within two months.

(7) Cultivation Augusta Hospital (Calves 13 and 14). From the bronchial glands of a man on whom *post-mortem* examination was made by Dr. Oestrich. A guinea-pig inoculated died in two months, and cultivations were made therefrom.

(8) Cultivation 800 (Calves 15 and 16), from the spleen of a guinea-pig, dead after one and a half months' inoculation with human tuberculous material.

(9) Cultivation 494 (Calves 17 and 18). From a guinea-pig inoculated with the tuberculous lung tissue of a man (Register No. 494 of the Pathological Institute), and which died after two months.

The accompanying table shows which cultivation has been employed, the intervals between the injections, and their influence upon the inoculated calves in respect to temperature and body-weight. All the calves were about 6 months old at the commencement of the experiments, and all the injections were intravenous.

All calves to be used in the experiments were first injected with tuberculin, and only such taken as did not show more than 0·5° C. rise. During the experiments the temperature was recorded twice daily, and the weight once weekly.

The second inoculation was usually made only when the calves had completely recovered from the first, an interval of four to seven weeks, as after the first injection the temperature suddenly rose to 40-41° C., and remained there some days. But later on also a temperature above normal was observed for about two weeks, with only a slight increase or even a decrease in weight. Then the temperature fell, and the animals recovered so completely within a few days that the second injection of bacilli could be made without hesitation. All these symptoms were, however, so little apparent, that only exact investigation and observation of the calves revealed them. A rise of temperature followed the second injection, but only lasted a few days, and did not disturb the general health of the calves.

In order now to test the immunity of the calves, 2 centigrammes of Culture XIV., or forty times the dose required to produce a lethal acute miliary tuberculosis in a calf within twenty to thirty days, was injected into the veins. For control injections, the same quantity (2 centigrammes) of the same cultivation was used, and to meet all criticisms the activity of the cultivation was tried on no less than eight calves at intervals during two years. In every case the infected calves died from general tuberculosis within a month.

The following table gives the results of the intravenous injections of Culture XIV. into the control animals :—

No. of calf	Day of injection	Quantity of intravenous injection	Day of death	Days after injection
14	Dec. 24, 1902	1 cg.	Jan. 16, 1903	23
1	,, 4, 1903	5 cg.	Dec. 26, 1903	22
2	,, 4, 1903	2 cg.	,, 29, 1903	25
6	Feb. 9, 1904	2 cg.	March 11, 1904	30
30	May 21, 1904	0·05 cg.	June 8, 1905	18
31	,, 21, 1904	0·05 cg.	,, 23, 1905	33
32	,, 21, 1904	0·05 cg.	,, 22, 1905	31

This demonstrates that the bovine tubercle cultivation used for control injections was of a very high degree of virulence.

With regard to the interval between the last inoculation with bacilli of human tuberculosis and the control injection, in Calves 1 to 6 it was only forty days. This interval proved *too short*. To this we attribute the partial failure in this series and the remarkable

irregularity of results, to which we shall refer in detail, as they appear particularly instructive.

Calf 6, which died thirty days after injection of bovine bacilli from acute miliary tuberculosis, received first an intravenous injection of 1 centigramme of a 29-day-old glycerine-agar cultivation (486), and exhibited a very violent reaction lasting about fourteen days. Thirty-three days later a further 5 centigrammes of the same cultivation was injected. For three days the calf was feverish, then the temperature sank. The general health was excellent. After injection with the bovine Culture XIV., the temperature rose suddenly and remained at 40 to 41° C. Cough, loss of appetite, and difficulty of breathing appeared and daily increased. On the thirtieth day the calf died and the *post mortem* showed acute caseated tuberculous inflammation of the lungs and of the lymphatic glands, &c.

Calf 5 was immunised at the same time with the sole difference that 2 centigrammes instead of 1 centigramme was injected as the first dose. It was inoculated with the same quantity of virulent bovine bacilli at the same time as Calf 6, but remained completely healthy in life, and *post mortem* showed it to be free from tuberculous changes.

Here was a remarkable case, that of two animals treated in almost the same manner; one died in consequence of the control injection, and the other remained perfectly healthy.

A similar observation was made with Calves 1 and 2. Both calves were immunised with the Friedmann cultivation, both exhibited like severe reaction, and were inoculated forty-two days after the last injection with 2 centigrammes each of the highly virulent bovine cultivation. Calf 1 bore the injection splendidly, increased in weight, always had a normal temperature, and was proved to be healthy on *post-mortem* examination. Calf 2, on the other hand, was continually feverish, and when killed after 165 days, the *post mortem* disclosed extensive tuberculosis of the lungs. It was true, however, that the tuberculous nodules in the lungs were encased in thick capsules, and perhaps would have healed if the calf had been left to live.

Here also there was a point of difference. The healthy Calf 1 had received 2 centigrammes at the first injection, the diseased Calf 2 only 1 centigramme. From these experiences we assume that by *the injection of larger quantities of tubercle bacilli in the first place, a larger and above all more rapid production of protective substances takes place, and that as immunity is very slowly developed, the control injection must be delayed as long as possible.* We believe that Calves 2 and 6 were only attacked severely because the period between the immunising treatment and the control injection had not allowed a sufficient degree of immunity to be developed.

Calves 3 and 4 of this series exhibited no considerable differences, and in both immunity was incomplete, as *post mortem* disclosed slight tuberculosis in the breast and flanks, as well as some tuberculous centres in the kidneys.

In the second series of experiments, Calves 7 to 18, we therefore only inoculated with bovine bacilli three months after the treatment with bacilli of human tuberculosis, and with exception of two, which showed slight remains of old tuberculous processes, all remained completely healthy. The only symptom of reaction was a slight fever that lasted three to five days. The animals developed very well and

increased in weight. Details are given in the table. Up to the time of going to press we had made *post-mortem* examinations of seven calves, after about a twelvemonth. Calves 8, 9, 12, 14 and 17, showed not the slightest signs of tuberculosis after very careful examination. Calves 13 and 15 showed a few old and healed tuberculous patches.

The five calves, 7, 10, 11, 16 and 18, still living, are in excellent condition, and free from all symptoms indicative of tuberculosis.

From the foregoing experiments it is evident that by treatment with bacilli of human tuberculosis in the manner described by us, a very high degree of immunity towards bovine tuberculosis can be secured, but that a considerable interval is required to allow the full development of the immune condition ; the quantity of the first injection appears to influence the rapidity with which the immune condition is reached.

In our experiments it was in principle immaterial which bacilli cultivations we employed, as all could produce immunity. *The property of immunising cattle without injury is therefore not peculiar to any particular cultivation.* The only difference was that the calves appeared to suffer more from some cultivations than others, the younger cultivations in particular generally causing more prolonged fever than the older, but these differences may perhaps be rectified by regulated dosage. In the same manner as with the bacilli of human tuberculosis we were also successful in establishing immunity with the attenuated bovine bacilli P.A. We injected intravenously into Calf 26 1 centigramme, and twenty-one days after 2½ centigrammes. The injections were well tolerated, although on both occasions a rather violent and continuous fever appeared. After one hundred and forty-eight days a control injection was made with the bovine bacilli Culture XIV. A rise in temperature followed and lasted about eight days, then the temperature fell and remained normal. The calf appeared healthy, and although the *post mortem* showed a chronic catarrhal bronchitis, it was not of tuberculous nature, and no tubercle bacilli could be detected, and guinea-pigs inoculated with the diseased lung tissue remained healthy.

In the foregoing experiments the immunising treatment consisted of two injections with bacilli of human tuberculosis. The second injection was, however, only followed by a slight reaction, and we think we may assume that perhaps one injection of not too small a quantity would suffice to give a sufficient degree of immunity to cattle. This is in accord with our previous experiments on asses and goats, where immunity was produced by one injection.

The severe febrile reaction after the injection of larger quantities of bacilli of human tuberculosis in calves did not deter us from such trials, as we had convinced ourselves of the harmless nature of this reaction. The practical advantages of one over two injections were a sufficient ground to try it upon a number of calves, as in the first place intravenous injections must be carefully made, and to obtain a sufficient degree of immunity with one injection would be a great economy of time and labour, and secondly, as the handling of living bacilli of human tuberculosis is not without danger to the operator, it is desirable to minimise it as far as possible.

For these experiments we selected from the cultivations previously used No. 482, as a moderate reaction followed its injection. Into

Calf 21 we injected intravenously 3 centigrammes, into Calf 22 2 centigrammes, and into Calf 23 1 centigramme of the thirty-day-old 482 cultivation. The general condition of the animal was not disturbed. After one hundred and three days we injected for control 2 centigrammes of our virulent bovine Culture XIV. Several days' fever followed, but after it disappeared the calves appeared quite healthy. Again, after one hundred and seventeen to one hundred and twenty-seven days, *post-mortem* examinations of all these calves, which had well developed, were made, and the animals found *absolutely free from tuberculosis.*

Thus three calves with a single injection of 1, 2 and 3 centigrammes respectively of bacilli of human tuberculosis, had gained a very high degree of immunity.

A similar result was obtained by intravenous injection into Calves 24 and 25 of 2 and 1 centigrammes attenuated bovine cultivation P.A., followed after one hundred and sixty-nine days by our highly virulent Culture XIV. Calf 24 lives still in excellent condition. Calf 25 was slaughtered on the two hundred and sixtieth day, and *post-mortem* examination showed that although in the interval it had suffered from chronic pleuritis, bronchitis, and peribronchitis, there were no signs of tuberculosis.

Consequently a single injection of bacilli of human tuberculosis or of attenuated bovine tuberculosis had sufficed to confer a high degree of immunity to infection with bovine tuberculosis.

At the present time we have treated a large number of calves in the above-described manner. All the calves have borne the intravenous injection of bacilli of human tuberculosis in doses of 1 to 3 centigrammes excellently. As the object of these trials is to determine the period of immunity conferred, we must keep them for various periods, at least twelve months, before making the usual control injection of 2 centigrammes highly virulent bovine tubercle bacilli. If these experiments show that the immunity disappears after twelve months, of course a second injection of human tubercle bacilli will have to be made. Although these trials are of the greatest practical importance, naturally some time must elapse before we can report further.

In conclusion, we recapitulate the present results of our experiments.

By a single injection of 1 to 3 centigrammes bacilli of human tuberculosis or of attenuated bovine tuberculosis, it is possible to render cattle immune to highly virulent bovine tuberculosis. The bacilli used must be cultivated on glycerine-bouillon, and have an age of thirty to forty days. They are dried between blotting-paper and the necessary quantity mixed with 10 cc. physiological salt solution injected into the veins. Immunity is only completely developed after a period of three months.

On the basis of the above experiments we believe ourselves justified in assuming that the problem of the immunity of cattle to bovine tuberculosis is so far solved, as the conditions are now known, that in laboratory trials animals can be with the greatest safety rendered immune to considerable quantities of the most virulent material, and in contrast to other diseases we can say that tuberculosis, about which only a few years ago the possibility of the production of a true immunity was generally doubted, can be safeguarded against by a comparatively simple method and with a high degree of security.

We must, however, recognise that the results so far are those of laboratory trials. The infective material we have employed to test the immunity of the animals has indeed been most virulent—more virulent, one would think, than that to which most animals would be exposed under natural conditions; nevertheless, the natural circumstances are different, and the behaviour of the artificially immunised animals must be studied under practical conditions. For such trials in practice we recommend that the conditions observed by us in making the protective inoculations shall, as far as possible, be followed in every respect, as our laboratory experiments have shown them to be the best.

BILIARY FEVER IN DOGS.

Malignant Jaundice, or Canine Piroplasmosis.

BY THE LATE D. HUTCHEON, M.R.C.V.S., DIRECTOR OF AGRICULTURE FOR THE CAPE OF GOOD HOPE.

(*A Paper read before the Western Province Kennel Club.*)

This is the most prevalent and fatal form of disease which affects the dog in South Africa. It was in 1885, when my headquarters were transferred to Port Elizabeth, that I first met with it. From clinical observation I looked upon it as an acute and specific form of congestion of the liver, accompanied by derangement of the digestive organs, a high temperature, a more or less jaundiced condition of the tissues, and the discharge of pontac-coloured urine. I called it Biliary fever because I had met with a similar disease of the horse which I had already given that name, and subsequent investigation has shown that they both belong to the same group of diseases. By the general public this disease of the dog was looked upon as a biliary form of distemper, but from a clinical study of the symptoms and pathological lesions, I had no hesitation in stating that, although in individual cases Biliary fever might be associated with distemper, it was quite distinct from it both in character and origin.

At the date which I refer to, this disease of the dog appeared to be confined to the East and South-west Coast districts of the Colony, but in subsequent years it was met with over a large area of the Cape Colony and the adjoining States and Colonies, principally along the main lines of traffic. An interesting question arises here: Is this disease indigenous to South Africa, or was it imported from Europe, where it is now known to exist, or did it come from the North or North-Eastern States of Africa, whence we have received some other of our tick-communicated animal plagues? I will refer to this point again.

During the subsequent years the study of Texas cattle fever—a disease believed to be closely related to our South African redwater—was made the subject of special investigation by the technical officers of the Bureau of Animal Industry of the United States. During 1888-89 Dr. Theobald Smith discovered a parasite within the red blood corpuscles belonging to the protozoa, which he named the *Pyrosoma*

bigeminum, on account of its pear shape and the fact that it usually occurred in pairs within the blood corpuscle. It was subsequently classed with the family of piroplasmosis, and named the *Piroplasma bovis*. Dr. Smith found that this parasite destroyed the red blood corpuscles so rapidly that in fatal cases the number present in a given quantity of blood was reduced to one-sixth of what it should be in healthy blood. During the same period Mr. F. L. Kilborne, who had charge of the camp experiments, demonstrated in 1890 that the cattle tick—*Boophilis bovis* (a species closely related to our blue tick)—was the active agent in communicating the disease to susceptible cattle and spreading the infection to clean pastures. It was these discoveries which led me, in 1893, to advance the following opinion with reference to the nature of malignant jaundice of the dog. I remarked, in reply to a correspondent in the *Agricultural Journal*, "that its pathology has not been clearly worked out, but it appears to be a special fever in which the blood becomes disorganised and the blood corpuscles broken up, thus setting free their colouring matter, which appears in the urine. The jaundice appears to have the same origin, accompanied by derangement of the secreting function of the liver. There is ordinarily no serious obstruction to the flow of bile from the bile ducts, and the *post-mortem* appearance of the liver is not often sufficient by itself to account for the deep jaundiced tint of the tissues and the dark brown colour of the urine, which are the prominent symptoms of the disease. The disease bears a very close resemblance to the redwater of cattle, which is understood to be due to a parasite which grows and multiplies in the blood corpuscles, breaking them up, and setting free their colouring matter, which appears in the urine; the accompanying derangement of the liver, and the jaundiced tint of the tissues, are secondary effects which in many cases are absent."

Subsequent to 1893 having but a limited staff, and more pressing work to attend to, it was not until 1899 that we were able to renew the study of this disease. The Sanitary Department of the Cape Town Council kindly supplied a few stray unclaimed dogs, which were used for the purpose of determining how the disease is communicated. Veterinary Surgeon Spreull was directed to carry out inoculation experiments for that purpose, and he very soon found that the disease was readily communicated to a healthy susceptible dog, by the injection, either subcutaneously or intravenously, of a small quantity of blood drawn from an affected animal. He found that when the injection was made subcutaneously the temperature began to rise about the sixth day, but when intravenously the temperature rises on the fourth day, and death takes place about the eleventh and seventh days respectively after infection. Meantime a specimen of the blood was forwarded to Dr. Carrington Purvis, Acting Director of the Bacteriological Institute, Grahamstown, for microscopic examination, and the following is his report:—

"I have to thank you for the blood of a dog suffering from malignant jaundice sent in a preservative liquid. I have carefully examined the blood, and find that it contains:—

"(1) Bacilli—no doubt extraneous.

"(2) Organisms, usually one to two in number, inside many of the red blood corpuscles. (The diagrams represent these organisms as similar to those present in Texas fever of cattle.)

"(3) Rounded or ovoid organisms inside what appear to be white corpuscles (but no nucleus could be made out); these corpuscles may be greatiy enlarged red corpuscles." He adds: "If these be really white corpuscles, they have evidently swallowed some of the parasites."

With respect to preventive treatment, Dr. Purvis recommended a trial of subcutaneous inoculation with blood from a dog which has recovered from the disease, as is practised for the prevention of the redwater of cattle. I add a note that "we intend to try that method, but it is very important to discover the manner in which the disease is ordinarily contracted by the dog—whether the parasite is conveyed to healthy dogs by ticks or other skin parasites, as the Texas fever of cattle is." Mr. Lounsbury then took up the subject. He says:—"I was studying ticks at the time with relation to a sheep disease, and naturally became interested in the possible connection of the subjects of my studies with this other disease. Thus was prompted the experiments which followed, which were conducted in conjunction with Mr. Wm. Robertson, of the Veterinary Department, and resulted in the discovery that the common dog tick of the country—*Hæmaphysalis Leachi*, Audouin—is the active agent in transmitting the infective parasite."

Time will not permit me to give the detailed account of these experiments related by Mr. Lounsbury, which were rendered more difficult and prolonged on account of the unusual habits or life history of the dog tick. Mr. Lounsbury says:—"Like all other *Ixodinæ*, both the cattle tick and the dog tick pass through three active life stages, viz., the larval, nymphal and adult. Preparatory to the transformation from one stage to the next, the feeding of the tick is suspended; thus, after an interval of variable duration, the old skin is ruptured, the tick crawls from it, and very soon seeks to renew its attack. The cattle tick normally stays on one animal throughout the several changes. It remains attached to the skin by its rostrum. After it suspends feeding, both as a larva and as a nymph, and hence, on the completion of the moult which follows, it has only to re-attach itself to the animal by its new mouth part, an act which it performs almost at once. The dog tick, on the other hand, perhaps because it infests an animal more energetic than an ox in locating and destroying skin parasites, has the habit of invariably loosening its hold and seeking shelter in the ground as soon as it ceases feeding before a moult; and, in consequence, it has the trouble of finding a host three times in its life instead of once, as with the cattle tick, and more often than otherwise a different dog is found each time. But a more troublesome peculiarity than the change of a host at each moulting was the fact, experimentally proved, that although the infected parasite is passed from the infected mother tick through the egg to the larval tick hatched from it, yet, although this young tick evidently harbours the infective parasite through its larval and nymphal stages, it cannot communicate the parasite to a susceptible host until it arrives at its mature or adult stage."

Dr. Nuttall, University Lecturer, Cambridge, in summarising the results of Mr. Lounsbury's experiments, says:—"The tick *Hæmaphysalis Leachi* certainly transmits the disease when infected with the parasite. To be infective the tick must be descended from a mother which has sucked the blood of an animal affected with the disease.

After the parent tick has gorged herself with blood she falls to the ground, and after a variable time lays a large number of eggs, from which hexapod larval ticks issue in due course. The larval ticks attack a dog when they have an opportunity, fill themselves with blood, and after about two days, drop off. According to the observations of Lounsbury, these infected larval ticks do not transmit the disease. After lying in the ground for a variable length of time the larval skin is shed, and the eight-legged nymphal tick issues forth. Lounsbury has also been unable to show that the infected nymphal tick is infective. The nymph in turn attaches itself to a dog for a few days, and having gorged itself with blood drops to the ground. Here it undergoes its metamorphosis, as did the larva, and after this is accomplished it casts its nymphal skin, and issues as an adult sexually mature eight-legged tick. It is the adult tick, and only the adult, which transmits the parasites, according to Lounsbury."

On this striking peculiarity of the life cycle of the dog tick, Mr. Lounsbury remarks:—"That the infection passes through the egg stage is a fact not unparalleled, and, therefore, not surprising; but that it is harboured through two feeding stages without being transmitted is at present wholly unique, and is a fact that considerably strengthens the inference that in this—dog disease—and the redwater of cattle, the ticks are not merely carrying agents, but are secondary hosts for the protozoan parasites." Upon this Dr. Nuttall remarks:—"The fact that the tick harbours the parasite after having undergone two moultings subsequent to leaving the egg, and that the adult tick is capable of infecting after having starved for five to six months, as I have found, certainly shows that the parasite must undergo some cycle of development as yet undetermined within the tick's body. It should dispose of the hypothesis advanced by Lignières in relation to the bovine parasite of *Tristeza*, or redwater, in the Argentine, that the manner in which the parasite is conveyed from the mother tick to the larva is the possibility that the parasite might adhere to the external mouth parts of the mother tick, after sucking infected blood, and be deposited from the mouth parts on the egg surface during the act of oviposition, when, as others have observed, the mouth parts play about the vulva."

The changes which take place in the blood have been carefully studied by J. Aldren Wright, M.D., of the Cambridge Pathological Laboratory, who states that a great reduction of the red corpuscles was a constant feature. In one dog the number fell from 5,800,000 per c.mm. to 1,000,000, and in another from 5,000,000 to 900,000 on the day previous to the animal's death. The red corpuscles were also altered in character; some were smaller than normal, while others were considerably larger, and these latter stained faintly. When the parasites appeared in the blood, nucleated red cells were also to be found, but usually few in number. In one instance enormous numbers were present, almost equalling in number the polynuclear leucocytes. A comparative count gave 48 per cent. nucleated red cells to 52 per cent. polynuclear leucocytes. As many as eight nucleated red cells could be seen in a single field of a one-twelfth of an inch objective. In this case the red corpuscles were altered in size and shape, and many of them were broken up.

The hæmoglobin was always diminished in amount, closely following the diminution in the number of red corpuscles.

Usually the leucocytes were greatly increased from the time the parasites appeared in the blood. In one dog they numbered nearly 52,000 per c.mm., and in another they increased to 60,000.

The tick which conveys the parasite in South Africa is "*Hæmaphysalis Leachi*, Audouin." It is supposed to be conveyed by the *Ixodes reduvius* in Italy, and in France by the *Dermacentor reticulatus*.

The Geographical Distribution of Hæmaphysalis Leachi.—This species appears to be almost confined to the African Continent. Neuman (1897, pp. 347 to 350) states that it was found in Egypt by Savigny, Mozambique by Karsch, Eastern Ethiopia by Antinori, West Africa, at Pangolin, by Mocqueryson, in Algeria by Fayet, in Sierra Leone by Trouessart, and Doumargue in the French Congo, Transvaal, Cape Colony.

The Manner in which the Tick Attaches Itself to its Host.—The tick fastens itself firmly on the host with its legs, directs its rostrum perpendicularly towards the skin, and on the selected spot thrusts in the terminal hooks of its chelifers. In proportion as these penetrate the dart follows, and the retrograde teeth on the under-surface of this organ ensure the stability of the apparatus in the wound.

Period of Incubation.—As already remarked, Spreull found, after intravenous inoculation, that the temperature began to rise on the fourth day, and death occurred about the seventh. After subcutaneous inoculation the temperature rose about the sixth day, and death followed about the eleventh day.

Mr. Robertson states that the blood is infective on the third day, and the parasites make their appearance in the blood corpuscles on the fourth day after subcutaneous inoculations with virulent blood.

Nocard and Motas report that infected corpuscles are rarely met with within thirty-six hours, and even after intravenous injection they do not usually appear until the end of forty-eight hours.

The parasite, having penetrated the blood corpuscle, grows in size, and then successively divides (usually) into 2, 4, 8, 16 individuals. Owing to irregularities in divisions, groups of 3, 5, 6, 7, 9, 10, 12, 14, 15, 18, and even 21, may be encountered, but division forms giving multiples of 2 (2 to 16) are by far the most numerous, and the usual number reached before the corpuscle ruptures and liberates its contents appears to be 16.

The Cultivation of the Piroplasma canis, by Kleine, in which the Irregular Forms of the Parasite Appear.—After various disappointments, during which the composition of the culture fluids were always being further simplified, we now employ solely diluted blood, and proceed as follows:—

A young dog is so infected with piroplasma that it will come to an end in three or four days. Shortly before death, at a time when the blood contains parasites in the highest number, the dog is bled under chloroform narcosis. The blood should then be defibrinated, and twenty sterile plugged test tubes taken, each containing 0·5 c.c. of physiological salt solution, and to each of these tubes 0·5 c.c. of such defibrinated blood is added. The diluted blood should be kept at a temperature of about 27° C. In about eighteen hours the clear fluid above the red corpuscles, which have sunk to the bottom, is removed, and the remaining deposit is examined. In this way one finds pictures, such as have been described by R. Koch. Their aspect is that

of large and complete club forms. Above from the thick end of the club proceed about half a dozen long fine rays, while the other end finishes in one, two or more prickles (Kleine).

Immunity.—The experiments conducted by Robertson and Lounsbury in this Colony, and by Nocard and Motas in France, clearly show that recovered dogs possess a strong immunity against natural or artificial infection for a limited time. The probabilities are, however, that permanent immunity can only be maintained by continuous infestation by infective ticks, as is known to be the case in redwater. With respect to the latter disease, observation and experience clearly show that if cattle salted to redwater are removed to an uninfective area for a period of twelve months or more, and are then returned to the infected area, a large proportion of these cattle will become re-infected, and contract the disease in a more or less severe form. Judging from the close relationship between the two diseases, it is only reasonable to believe that the same results would follow similar treatment in the dog. An animal which has recovered from either *Piroplasma canis* or *P. bovis* has not, in the proper sense of the term, acquired an immunity to the invasion of the infective parasite, but simply a strong tolerance to the presence of the parasite in the blood. For example, Mr. William Robertson kept a dog which had recovered from this fever from November 4, 1901, to April 15, 1902—over five months—and during that time he inoculated eleven healthy dogs, at intervals, with blood drawn from this salted dog, and every one of the inoculated dogs died of the disease. The peculiarity about this animal's blood was that Robertson could not detect any of the causal parasites in the blood, although he searched for them persistently. They must, however, have been present in some form, although unrecognisable by the microscope. A similar phenomenon is witnessed in cattle which have recovered from redwater; if you leave these cattle on actively infected veld during the summer, and use their blood to inoculate healthy susceptible cattle, the inoculation produces a virulent form of the disease, and very often followed by a heavy mortality. If, however, you clear these cattle of ticks and take them to non-infective veld, after a given time the blood of these cattle becomes less and less virulent, and can be safely used to inoculate susceptible cattle, as it produces a comparatively mild form of the disease, until it ceases to give any fever reaction at all; but when that time arrives the salted animal itself becomes susceptible of a second severe attack of the disease, which may prove fatal.

Mr. Robertson's experiments with the blood of recovered dogs, however, indicate that the blood does not gradually lose its virulence with time; when inoculated into a susceptible dog it either produces a severe form of the disease while infection lasts, or no fever reaction whatever. This is a point, however, which, perhaps, requires further study.

Nocard and Motas, who conducted some experiments in 1902, with the object of trying to confer an immunity on dogs exposed to infection, state that the serum of recovered dogs possesses bactericidal action. They say that when one quantity of virulent blood is mixed *in vitro* with three, four or five quantities of serum from a dog which has recovered from the disease, the mixture can be injected with impunity into clean dogs even intravenously. These dogs give no

fever reaction, nor can parasites be found in their blood. No immunity is, however, conferred.

They add:—The microbicidal action of the serum is, however, observed to be much more pronounced when the dogs have been highly immunised by repeated injections of virulent blood; that when injected in large doses this fortified serum can considerably retard or even hinder the fatal action of the virus inoculated twenty-four to forty-eight hours after. They further state that the preventive action of a given serum exerts itself in a much smaller dose when the serum is mixed with the virulent blood before the inoculation is performed. I quite agree, but the fever is less, and the immunity correspondingly short.

All that I can say with regard to these statements is that Mr. Robertson, who devoted a considerable amount of time in trying to verify the results obtained by MM. Nocard and Motas, failed to confer an immunity of any duration. I am of opinion, therefore, that Nocard and Motas are much happier in their explanation of what they term

The Mechanical Cause of the Immunity.—They state that in the blood of the sick animals, especially of those which are on the road to recovery, an active phagocytosis is produced. It is common to observe large mononuclear corpuscles which have absorbed two, three, four, and up to six red globules, all of them infected; of these globules some have already lost their hæmoglobin; others are coloured almost as well as the normal globules; between these two extremes all the intermediate stages can be seen; the former have their parasites rounded, very small, scarcely coloured, with an ill-defined contour; in others the parasites, likewise small and round, are strongly tinged, and their contour is clearly prominent.

This phagocytosis operates equally in the depth of the organs: it is observed to be very active on the sections of the spleen, even in dogs which have succumbed to the acute form of the disease. Everywhere mononuclear corpuscles can be seen stuffed with parasitic globules in process of digestion. Sometimes the phagocyted globules are so numerous that the phagocytes give the illusion of a capillary which has been severed across.

The infected blood corpuscles are invariably absorbed by the mononuclear; we have never seen a single globule phagocyted by a polynuclear; it is, nevertheless, probable that the polynuclei also contribute to the defence by absorbing the free parasites in the plasma. If, however, these phagocytes were to maintain their activity after the recovery of the animal, one would naturally expect that the whole of the infective parasites would very soon be completely destroyed; but such is not the case. It will be observed that the blood remains infective for many months after the animal has made a complete recovery. Further, as soon as the blood of the recovered dog loses its power to infect a susceptible animal, the recovered animal loses its immunity. What, then, becomes of the antitoxic or microbicidal action of the serum. It does not inhibit the life of the parasite after convalescence, neither does it appear to exercise any influence to prevent the reintroduction of the parasite when the dog is again exposed to tick infection.

As I have already remarked, permanent immunity can only be maintained by continuous tick infection. Here is where the difficulty of devising effective preventive measures comes in. It is compara-

tively easy to keep a dog clean and free from ticks if you keep him off the veld. But in the case of a sporting dog, the more effectively you clean him, the more liable he becomes to pick up infective ticks and contract the disease when he is taken out for shooting or hunting.

It is very important to know, however, that young sporting dogs may be reared with comparative safety, if their kennels and runs are kept clean and free from ticks; providing also, that no infected or recovered dogs are allowed to enter these particular kennels where these young ones are reared. These precautions are recommended, not because this disease is directly infectious, but because even one adult tick getting on to the infected or recently recovered dog, would breed out as many young ticks as would, in the succeeding few months, be capable of infecting the whole of the susceptible dogs in the kennel. In fact, all infected and recovered dogs should be kept strictly isolated in kennels by themselves, as they are the source and distributing centre of the infective ticks.

Symptoms.—In those cases artificially produced by inoculation the temperature begins to rise about two days, in some cases more, before the visible symptoms become manifest. The first visible symptoms are, the animal appears dull and listless and lies down more than usual, later on it does not change its position for hours, it does not care to feed; it may, however, attempt to eat a little when some tempting food is placed before it. Very soon it refuses all food, but manifests a strong craving for water, of which it will drink large quantities if it has free access to it. It is difficult, notwithstanding this thirst, to induce the animal to take a little milk with its water. In some cases vomiting is an early symptom, but in others it is not observed, except when food is injudiciously forced down the patient's throat, when the stomach invariably rejects it. The urine becomes dark red in colour, deepening in tint to a claret or a pontac hue. Hæmoglobinuria and albuminuria are usually present in acute fatal cases, they may, however, be absent in some cases which prove fatal. The visible mucous membranes become pale and icteric changing to a deep chrome-yellow colour; the hairless portions of the skin take on a similar hue. The breath has a fœtid sickening odour, the tongue is furred, and sordes accumulate on the teeth. The pulse is quick and feeble; the breathing becomes laboured and finally shallow. Towards the end the animal totters in its gait; becomes unable to stand; lies helpless, and dies comatose. The body temperature oscillates from 104° to 105°, and may rise to 106° or even 107° F.; on approaching death it may fall two or more degrees below normal.

Post-mortem Appearances.—The *post-mortem* lesions in those cases which are produced artificially by inoculation are very similar to those in which the disease is contracted in the usual manner, and are briefly as follows: body emaciated, subcutaneous tissues and fat and superficial muscles stained yellow. The intra-abdominal fat is of the same colour: ecchymosed spots varying in number and size on the epicardium and endocardium, most intense in the left ventricle. In many cases the pericardium contains a variable quantity of a serous fluid. The lungs are rarely affected, but in some instances a variable amount of a brownish-coloured serous fluid is found in the thorax, and in individual cases a similar fluid has been found in the abdominal cavity. The liver, in the majority of cases, is more or less congested

and enlarged, friable, and varies in appearance from a mahogany colour to a deep saffron hue. The bile is generally of a very dark green colour and thicker than natural. The spleen is usually much enlarged, and its pulp much darker and softer than natural. The fundus of the stomach is generally highly congested, and a few small spots like ulcers may be observed on its rugæ, but the pyloric end is usually normal.

There is a catarrhal and bile-stained condition of the mucous membrane of the small intestines; the lumen of the bowel contains a quantity of viscid mucus. "The large intestines are inflamed throughout, with copious exudate of a rusty-red colour on the mucous membrane. Kidneys externally bile-stained, and on section paler than normal in the cortex (Robertson). The urinary bladder appears healthy, but the urine is generally of a dark colour resembling claret or pontac, with a fœtid odour.

Discussion on Preventive and Curative Remedies.—There can be little doubt that if a safe and effective method of preventive inoculation could be discovered, one that could be applied say every six months in order to maintain the immunity, that would be the most satisfactory method, and I am not without hope that such a means may be discovered.

Meantime some amelioration of the danger might be effected by dressing the sporting dogs in the morning before going out with some lubricating mixture, which would tend to keep the ticks off, and be capable of being washed when the dogs come in at night. Paraffin and soap emulsion was suggested, but one sportsman present pointed out that when a sporting dog is dressed with paraffin it interferes with the delicacy of his scent, and he is useless. I am afraid that any other disinfectant having a strong odour would have a similar effect. I mentioned that many of the farmers made a deep clay puddle, through which they drove their oxen before sending them on a journey; the clay dried on the legs and feet, and, it is said, prevented the ticks from attaching themselves to the skin.

Sulphur and arsenic were mentioned as preventives. I pointed out that a number of experiments had been made by Mr. Lounsbury in order to test the value of sulphur as a preventive of ticks when given internally, and he clearly proved that even when given in large doses continuously for long periods, it completely failed either to prevent the ticks from invading the animal, or to cause them to drop off before they were mature or ready to fall. It is not an effective remedy, even when applied externally, although it is one of the best cures for scab. With regard to arsenic, in some of its compounds it is one of the most effective external dressings or dipping mixtures for the destruction of ticks, but it would have to be used with caution on the dog, especially on those with long coats. There would be a danger in bathing dogs at short intervals in arsenical mixture of sufficient strength to kill the ticks. With regard to its continuous internal administration in small doses, it is very probable that it would greatly assist in preventing the development and multiplication of the causal parasite in the blood, and prove beneficial in that way. The great consideration is an adhesive, emollient, odourless dressing for the dogs before going out to the veld, which could be easily washed off on returning to the kennels.

With respect to curative remedies, their name is legion, and I have nothing original to offer. In our experience we have found that if the patient is discovered early, a good dose of calomel should be given at once, and followed up by a pill containing 1 to 2 grains of calomel and 5 to 10 grains of quinine, three times daily for some days. The patient should be kept clean and comfortable, and induced to take a little nourishment. It is of the utmost importance to watch the dogs, in order to detect the first symptoms of dulness and loss of appetite. When such symptoms appear a dose of calomel, from 2 to 5 grains, depending on the size of the dog, should be given at once. This is a dose which is likely to do good, even if it is only acute indigestion or congestion of the liver from which the dog is suffering. The majority of dogs are in an advanced stage of the disease before they are observed by the owner.

(*Agricultural Journal of the Cape of Good Hope.*)

TREATMENT OF PNEUMONIA IN THE HORSE.

BY M. V. DROUIN.

In a former paper on pneumonia in the horse (*Revue Générale*, January 1, 1905, vol. v., p. 1) the author discussed the clinical and bacteriological aspects of the subject. He pointed out that there appeared to be a specific organism present in the hepatised mass of lung, depending on whether the disease was typhoid, a rigor, or from strangles; whether it was lobar or lobular, isolated or epidemic. He expresses a hope that before long a protective serum may be found, but till then ordinary therapeutic means must be had recourse to, and then he proceeds to review.

Hygiene.—We all are unanimous that a plentiful supply of fresh air is necessary, and even some of the most modern and best stables fail in this respect through faulty construction. Some go so far as to advocate turning the patient out into the open irrespective of the season of the year (Joly, Hutyra, Marek, Thomas, *Bulletin de la Société Centrale de Médecine Vétérinaire*, 1897, p. 455; Alix, *Ibid.*, 1898, p. 300), but the author thinks that this is going to extremes. Encouraged by the good results of open-air treatment, Kantorowiez, Eberlein and Tœpper (*Revue Générale*, 1903, vol. i., p. 269) advocated the inhalation of oxygen. The gas is sold compressed in steel cylinders, and is used in many industries; and its administration is simple, the cylinder being attached to an inhaler by a rubber tube. The gas is given from five to ten minutes twice a day. Under its influence the temperature is not affected, but the pulse becomes stronger, and the period of convalescence is shortened. About 1,000 litres of gas is sufficient, at a price of about 6 francs. The inhalation of oxygen is particularly useful where asphyxia is threatened, especially in cases of bilateral pneumonia.

The digestive system has to be carefully attended to. The mangers must be carefully cleaned out, especially in the corners, where morbid germs are likely to be carried by rats and mice (Thomas), and the bowels must be kept moving by laxatives. The author recommends Carlsbad salts. Secondary pulmonary infection is always

to be feared from the intestines; it has been frequently remarked that pulmonary gangrene is preceded by bowel trouble, particularly a fœtid diarrhœa, and the altered intestinal wall facilitates the passage of organisms.

The use of milk as a food fulfils a double function, not only on account of its nutritive properties, but because it diminishes the number of organisms in the bowel, and also promotes diuresis. In country places where milk is cheap and easily obtained its use is of the greatest value.

Both the mouth and the rectum should be washed out with antiseptics, but carbolic acid and cresyl are to be avoided, they irritate the mucous membrane, and give rise to unnecessary straining and discomfort. Nutritive enemata can be given by the rectum if the animal will not feed, such as gruel, white of egg, milk, sugar, and beef tea. Johne recommends rinsing the mouth out with clean fresh water as the best means of restoring the appetite.

The points to be considered are—

(1) To combat pulmonary congestion.

(2) To lower the internal temperature.

(3) To guard against complications (gangrene, pleurisy, &c.).

Bleeding.—The most primary danger is pulmonary congestion. The respirations become short and quick, the conjunctiva deeply injected, and the nostrils widely opened, with an anxious expression in the face. In such cases bleeding is indicated, and is particularly useful when asphyxia is threatened.

Bleeding has lately gone out of fashion, and the author thinks without reason. Trasbot, Benjamin and Mollereau recommend it, but of course it must be used with discretion.

Cadeac, Hutyra, and Marek pronounce against bleeding. The author thinks that at the commencement of an attack of pneumonia, when the respirations are difficult and the membranes injected, that bleeding is useful, but he strongly objects to its repetition, which in his opinion is dangerous.

Revulsion.—The use of revulsions is general all over the world, and goes back to very ancient times, authors who are in favour of it only differing in the particular agent they employ. Most text-books recommend mustard and blistering ointments, but these the author completely condemns.

If a mustard blister is left on the animal it gives rise to great pain, and the difficulty in breathing is increased; this is increased by the pungent fumes that fill the air. It is only necessary to go into the box of a patient to whom a mustard plaster has been applied to be convinced in one's own person of this.

The swelling and œdema that take place between the fore legs interfere with the animal's movements and comfort; it also embarrasses exploration of the chest, and tapping, should it become necessary.

The effects of mustard are most variable, sometimes it is almost inactive, at others it will cause the skin to slough. M. Joly (*Maladies du cheval de troupe*), who was at one time an advocate for its use, says: "I wrote these lines in 1890, but since then I have been very sparing in the use of mustard."

Blistering ointments, more especially mercury, have to be used with even greater precaution. If they contain cantharides, they are

likely to give rise to renal complications. They are also likely to cause sloughing of the skin, with ugly blemishes. Burnet, however, claims to have had good results with the following formula :—

Unguentum borilicum	500
Cantharides	100
Euphorbia	50
Croton oil	10

Turpentine is painful, and its effects are only temporary. These inconveniences may be avoided by using applications that are more regular in their action, the one recommended being known in the French Pharmacopœia as *Feux Anglais*. It is composed of euphorbia dissolved in oil, cantharides in turpentine, with the addition of croton oil, but the official preparation, the author considers, is not strong enough.

It can be applied with a pledget of tow or a brush without friction, and in fine-coated subjects it is not necessary to clip the hair. It acts quickly, the epidermis falls off in a few days, leaving the roots of the hair intact, and in a few days' time new hair begins to grow.

D'Arboval gives the following formula :—

Croton oil	2
Turpentine	10
Ether	30
Spirit	60

Bourgés (*Bulletin de la Société Centrale de Médecine Vétérinaire*, 1899, p. 287) recommends this formula.

Roy (*Ibid.*, 1900, p. 604) uses the following :—

Croton oil	xiv. minims
Ol arackis (monkey nut oil) ...	2 centilitres

Another method of causing revulsion is to inject a liquid irritant under the skin. Blanchard (*Ibid.*, 1903, p. 490) uses this formula :—

Chloride of sodium, pure	100 grammes
Boiled water	500 ,,
Liquor ammonia acetatis	500 ,,

50 cc. injected daily.

Hutyra and Marek use camphorated oil in the same manner, and 5-gramme doses of turpentine under the skin of the chest is most useful in place of the old-fashioned seton. Cagny recommends bags of hot sand.

Lately cold has been suggested as a substitute for irritants, such as ice, and for a long time past Priessnitz's compresses have been extensively used in Germany.

Some interesting observations have been made in France. In 1897 Brun (*Ibid.*, 1898, p. 292) published some favourable results obtained by the application of ice-bags to the sides of the chest and subcutaneous injections of ether and caffeine. He has invented a special apparatus, so that the ice comes in contact with the whole of the chest up to the top.

Alix (*Ibid.*, 1898, p. 300) recommends the chest being enveloped in wet cloths and cold douches.

Woronzow has treated 250 cases of pneumonia among the St. Petersburg tramway horses by cold applications, with a mortality of 4 per cent., and Dumas (*Recueil de Médecine Vétérinaire*, 1904, p. 31) reduced the mortality in an outbreak of infectious pneumonia from

47 to 12 per cent. by wet packs to the chest changed every forty-five minutes. Each time the pack was changed the skin was dried and a dry rug put on. The pack was used six times in twenty-four hours.

Giugiaro (*Revue Générale*, 1903, vol. iv., p. 292) and Querrnau (*Bulletin de la Société Centrale*, 1900, p. 268) have altogether given up the use of revulsions, which they completely condemn.

The author thinks that this is going to extremes. The treatment of pneumonia by ice has not made very much progress in France, and Hutyra and Marek, who are its warmest advocates, do not use it in the very cold weather.

Dr. Carl Ullmann (Bayer, *Revue Générale*, 1904, vol. i., p. 133) has invented an elaborate apparatus, that he terms a hydrothermo regulator, which keeps the wet packs at a constant temperature of 42° to 43° C. He claims for this apparatus that the increased heat of the skin arrests the action of the phagocytes.

Antithermic Treatment.—The object is to reduce the temperature, and almost every antifebrile drug in the pharmacopœia has been recommended in turn. Cold enemas were at one time in favour, but they now seem to have dropped out of fashion.

The drugs that have been chiefly used are quinine, antipyrine, antifebrine, phenacetine, veratrine, aconitine, and salicylate of soda.

Leblanc (*Bulletin de la Société Centrale*, 1898, p. 292) strongly advocates sulphate of quinine in 5-gramme doses morning and evening. He states that it causes a rapid drop in the temperature, and consequently improvement in the most urgent symptoms; and convalescence is shortened. Mouquet prefers the hydrochlorate to the sulphate of quinine.

Cadeac and Joly prefer antifebrine or antipyrine in large doses (20 to 30 grammes), they both are cheaper than quinine. Friedberger and Fröhner use antipyrine in repeated doses of 15 to 25 grammes, and even more. Phenacetine has a more lasting action than antipyrine, and can be given in doses of from 10 to 20 grammes per diem.

Cagny recommends veratrine (0·01 to 0·05 grammes), either the basic form in alcohol or the sulphate dissolved in water, hypodermically, in conjunction with quinine internally.

Salicylate of soda is advocated by Alix (*Recueil d'hygiene et Médecine Vétérinaires Militaires*, vol. viii., 1906, p. 241), but to get the full effect it has to be given in very large doses, 50 to 100 grammes. Alix used it in fifty-one cases in an epidemic of lobar pneumonia without losing a single case. On a former occasion the same author used as much as 150-gramme doses.

Roy (*Bulletin de la Société Centrale*, 1900, p. 604), gave a mixture of 40 grammes of salicylate of soda, 15 grammes turpentine, and 100 grammes alcohol.

Aconite and aconitine have also been recommended, especially the nitrate of aconitine in 2 to 3 milligramme doses subcutaneously.

In England and America heroin has lately come into favour; it is both an anti-thermic and a dissolvant of the bronchial exudates, as well as a cardiac stimulant. Smith's glyco-heroin in conjunction with turpentine is the preparation most commonly used. Meyer, of New York ("The use of Heroin in Pneumonia," *American Veterinary Review*, March 1903), considers it the most useful agent in pneumonia that has yet been brought out, and that it acts on the lungs in the same way as digitalis does on the heart.

Tartar emetic, which formerly was looked on as the sheet anchor in pneumonia, has fallen entirely into disfavour. Cadeac altogether condemns it, and in such cases Gunter looks on 12-gramme doses as poisonous.

The use of antithermics alone is, however, on its trial. Hutyra and Marek are distinctly against them, and are in favour of cardiac tonics.

Cardiac Tonics.—Recently attention has been turned to the condition of the heart in pneumonia. The cardiac muscle is fatigued by the consolidation of the lung, and furthermore is semi-intoxicated and asphyxiated—the strain on it is enormous. It need not be pointed out that the results of any stoppage or interference with its action would be fatal, and on this account digitalis, strophanthus and caffeine have numerous partisans.

Digitalis is given in 5-gramme doses daily for a week. If it is required hypodermically the pharmacopœial solution should be used, which contains 1 milligramme of digitaline to the cubic centimetre. Friedberger and Fröhner use as much as 10 grammes of digitalis in conjunction with alcaline. Some practitioners regard digitalis as a specific in pneumonia.

Hutyra and Marek prefer strophanthus in the form of the tincture to digitalis, the dose being 10 to 25 grammes. Regenbogen, on the contrary, had bad results following its use hypodermically from suppuration.

Caffeine is both a cardiac tonic and diuretic. It is given in conjunction with benzoate and salicylate of soda.

Alcohol, as every one knows, has been used for years past. Unfortunately its effects are very temporary, and it is succeeded by great depression. In certain forms, however, of pneumonia, especially where gangrene is threatened, it is exceedingly useful if given in small doses often repeated, 25 to 50 grammes of brandy. Cadeac, however, gives 100- to 200-gramme doses, but this Friedberger and Fröhner think is too much.

All the other tonics, nux vomica, strychnine, quinine, gentian and ether, have their advocates. The use of these must, however, be looked upon as a mere adjunct, and they are gradually falling into disuse.

Local Antiseptics.—Pneumonia being a disease that is localised in an organ that has direct communication with the exterior, is amenable to local treatment, such as inhalations, fumigations, and intra-tracheal injections of antiseptic substances. Friedberger and Fröhner recommend inhalations of tar, cresyl, turpentine, and juniper berries. These Cadeac thinks are useless. The author goes further, and looks on them as being absolutely harmful. They do not penetrate very far into the bronchial tubes, and they cause violent coughing, which greatly distresses the patient, and to his mind fumigations are quite useless or worse than useless in pneumonia.

In order to obtain the same result without these inconveniences, M. Joly used dry antiseptic inhalation by smearing the nostrils with cresyl, iodoform, or carbolic acid in vaseline 1 to 10. This plan has the advantage of sterilising the nostrils and upper air passages, without the danger of asphyxia.

It has been suggested that antiseptics might reach the lung through the blood or the digestive system, and with this object iodide of potas-

sium, turpentine, and creosote have been prescribed. This theory, however, is far fetched, for even if they had any action on the organism of pneumonia, they undergo alteration in passing through the stomach. Furthermore, they have the great drawback of giving rise to nausea. Iodide of potassium would appear to be the only one that is at all admissible. Trasbot uses it in conjunction with salicylate of soda.

Lately tallianine, which is an ozonised turpentine, has come into use in veterinary practice, and Gautier has recently made a communication to the Biological Society of France on its properties, which, briefly, is to increase the action of the leucocytes. Tallianine is sold ready prepared in tubes, and is injected directly into the jugular vein. According to Pichard, Coty, and several others, it has a most marked effect in pneumonia and other diseases, in which stimulation of the defensive action of the leucoytes is the basis of treatment. The author is not quite as enthusiastic as some are as to its value, but he acknowledges that it is useful, and furthermore has the great advantage of being easily used; it is, however, somewhat expensive. Collargol (colloidal silver) has been used in the same manner with the same object.

Intra-tracheal Injection.—When gangrene threatens the question arises is it permissible to bring drugs to arrest it directly in contact by means of the trachea. The experiment has been tried several times with variable results. Masson and Vayeux (*Journal de Médecine Vétérinaire*, 1904, p. 407) have used creosote. The following is their formula:—

Creosote	1
Alcohol	40
Water	40

Twenty cubic centigrammes injected into the trachea.

They report two successful cases, one of which was a case of pneumonia from a foreign body in the lung. Bottini used a 4 per cent. solution of formal in 10 to 12 cc. doses twice a day, and Joly iodoform and ether or Lugol's solution of iodine.

Cadeac, on the contrary, states that intratracheal injection is useless. He had several successes, but afterwards he was disappointed. It, in his opinion, should only be used in very desperate cases.

The author questions the utility of attempting to cure a case of pulmonary gangrene. He has had several under his hands that have recovered, but they have never been much good afterwards.

When gangrene is threatened, Trasbot recommends camphor, carbolic acid and alcohol; Hutyra and Marek, spraying with a 1 per 2,000 solution of corrosive sublimate, and Friedberger and Fröhner, turpentine, camphor and alcohol. Fairier (*Revue Générale*, September 1 and 15, 1906, vol. viii., p. 225), has endeavoured to use gelatine serum 1 to 1½ per cent.

Pleurisy is a complication that is to be feared, and nearly all modern writers, Huguier (*Thoracen-terr, Bulletin de la Société Centrale*, 1896); Jobelot (*Ibid.*, 1897, p. 535); and Mouquet (*Ibid.*, 1897, p. 535), advocate early tapping should fluid form in the chest. Brocheriou (*Bulletin de la Société Centrale*, 1901, p. 128) has obtained some remarkable results by repeated tapping associated with subcutaneous or intravenous injections of physiological serum; he has given as much as 20 litres of salt solution. Poinot (*Recueil de Médecine Vétérinaire*, 1901,

p. 13) and Lienaux (*Ibid.*, 1903, p. 323) confirm Brocheriou's observations. Fröhner mentions another advantage that early tapping possesses, viz., that it is a valuable means of prognosis, as in benign cases the exudate is sterile, in serious ones it is rich in micro-organisms. When the lesions begin to subside diuretics are indicated, as in convalescence from all fevers. Huguier recommends nitrate of potash in 30- to 50- gramme doses. Large injections of saline solution (blood washing) re-establishes tension in the vessels, and unite in the excretion of refuse materials.

Serotherapy.—The use of specific serums is based on Lignières' discovery that in pneumonia, no matter what its origin is, there is always a streptococcus present. Since 1903 a polyvalent serum has been prepared at the Pasteur Institute (Nocard: *Bulletin de la Société Centrale*, 1903, p. 309). Rohr has obtained good results with it, the maximum dose he used being 30 c.c. in the day, and it is now largely used by a number of practitioners. M. Joly has employed it on a large scale at the Saumur cavalry school. He states that the total amount used during the six days that treatment lasts is about 160 c.c. per head. Walter (*Zeitschrift für Veterinarkunde*, November, 1902) has also introduced it into use in the Saxon army.

The author has had considerable experience with it and speaks of it with approval. He finds that it rapidly reduces the temperature, and that by its use the period of convalescence is shortened, but that recourse must be had to it early in the case. If there are not marked results within the first four or five days it is, in his experience, no use continuing with it. The dose recommended is from 20 to 40 c.c. per diem, and its cost is moderate. Veleniewskiy ("Gougres des Vétérinaires Russes," *Revue Générale*, 1903) has also prepared a serum from a special organism that he is said to have discovered.

Vaccination.—When the contagious nature of certain classes of pneumonia was first recognised great hopes were entertained that a vaccine would be discovered, but up to the present a reliable one has not been brought before the notice of the profession. Lignières has, however, published some remarkable observations (*Bulletin de la Société Centrale*, 1898, pp. 849-853, and *Revue Générale*, 1905, p. 435), and states that he yet hopes to produce one. MM. Dassonville and de Wissocq in France, and a commission appointed by the Italian Minister of War, are also inquiring into the same subject.

(*Revue Générale de Médecine Vétérinaire.*)

ANNUAL STATISTICAL REPORT OF THE ARMY VETERINARY DEPARTMENT FOR THE YEAR ENDING MARCH 31, 1906.

THIS report deals with the horses and mules of the Army in the United Kingdom, South Africa, and Egypt, but not in India. The number of animals, horses and mules on that date are given as :—

	Horses.	Mules
United Kingdom ...	22,218 ...	—
South Africa	6,257 ...	3,417
Egypt	327 ...	101
	28,802	3,518

The rate of inefficiency was 0·89 per cent. higher, and the death-rate 2·43 per cent. lower than the previous year. The number of admissions was higher in the Irish command, 114·77, and lowest in the Southern, 76·25. Surgical diseases and injuries are the chief cause of horses being admitted to hospital; this is explained by the fact that in certain cases they have been overworked when out of condition.

After the South African war a good deal of comment was made on the waste of horseflesh, which was partly attributed to the ignorance of officers and soldiers. Great stress was laid on the necessity of instruction in horse-mastership and stable economy, but there would appear to be still room for improvement.

There were only eight cases of glanders, compared with seventy-nine the previous year, and it is not surprising to learn that the majority were in the south of England, as the disease has been rife in the metropolis for years past.

Unfortunately, epizootic lymphangitis still exists, twenty-six cases being reported. This disease is a legacy of the South African war, and was introduced in the teeth of the advice given by both the civil and military veterinary authorities. How much this disregard of professional opinion has cost the country, both directly and indirectly, will never be known.

Taking it on the whole the report is satisfactory, and great credit for the health of the horses is due to the veterinary officers; but there are certain small matters that we must comment on.

The report in question differs in form from former ones we have seen, and runs into 184 pages, which we think might well be curtailed for all practical purposes.

A long series of tables of each class of disease is given after each command, and an abstract at the end. These tables are again condensed into a single general one at the commencement of the report, pages 8 to 14. The abstract from each command and the general condensed table would, we think, be ample.

On page 7 in the report on the Army Vaccine Institute at Aldershot, it is stated that twenty-nine calves were vaccinated during the year, and that twenty-seven were slaughtered and examined, but two were sold alive. No doubt care was taken that these two calves were not sold to butchers, but we think it would be more satisfactory if all calves used in the institution were killed. Some years ago there was a good deal of public discussion of a highly coloured nature in the Press about the sale of calves from a vaccine institute, and it does not appear wise to endanger the Aldershot one, which has done admirable work at a nominal cost in the eyes of the public. We think that instructions should be given that no calf leaves the institution alive under any circumstances.

On page 16 we notice a proposition from the P.V.O., Aldershot command, which we most certainly protest against, viz., that cast and condemned army horses should be made up prior to sale at a remount depôt so as to fetch a higher price. Possibly a few shillings more

might be got, but they would come out of the pockets of a class of horse owner that can but ill afford them. Cast army horses are as a rule only bought by very poor people, who are aware that they are being sold for some defect or good reason, but that they are seen at their very worst. If the notion once got abroad that their horses were made up for sale we are afraid they would soon only become marketable for cat's meat. In any event we object to Government making a profit out of such a class of customer, and we trust nothing more will be heard of the matter.

We are much astounded to learn that there is no central station hospital at Aldershot. We were always under the impression that this was the very centre of the latest military improvements.

On page 35 it is said that mange had again broken out at the Woolwich Remount Depôt. During the African War, when we assisted the Army in buying remounts, we heard what seemed to be common knowledge, that the Woolwich Remount Depôt was an infected place, and had frequently been condemned as unsuited for the purpose. We thought it had been abolished some time ago. We were only there once and for a few hours, but we came away with the impression that Woolwich was a most unsuitable place to keep remount horses in, and that the land was too valuable for such a purpose.

Egypt and South Africa are foreign countries to us, but we see that the P.V.O. in the latter country expresses his opinion on the horses and condition of his department in no measured terms.

It seems a pity that the annual report of the Army cannot be made more interesting to the general practitioner, like that of the Principal Veterinary Officer of the New Zealand Agricultural Department, a copy of which for 1906 is now before us.

Of course the two are different, but we cannot help thinking that more might be made out of the material for observation that the Army supplies that would be of interest to the general practitioner than is done at present.

We make these remarks in no carping spirit. They are only suggestions, and we trust that our military *confrères* will take them in good part.

BERLIN VETERINARY SCHOOL.—REPORT FOR 1905-6.

DURING the summer session 400, and winter 416, students were on the roll of the school, and 21 military students. One hundred and ten candidates presented themselves for the final examination, of whom 97 passed.

One thousand seven hundred and eighty-seven horses and 1 donkey were treated in the medical wards under Dr. Fröhner, and 760 horses in the surgical under Dr. Eberlein. Six hundred operations were performed. Six thousand nine hundred and thirteen large animals attended as out-patients under Dr. Karnbach, and 1,908 minor operations were performed. In the canine ward, under Professor Regan-Vogen, 1,260 patients were treated and 244 operations performed. Eight thousand dogs, 181 cats, and 14 monkeys attended as out-patients, and 632 minor operations were performed.

Post-mortem examinations were made by Dr. Schütz on 305 horses, 1 donkey, 2 oxen, and 113 dogs. Professor Eggeling paid 453 visits and treated 52 horses, 486 oxen, 561 pigs, and 3 goats.

Review.

THE PRINCIPLES OF VETERINARY SURGERY. By Louis A. Merillat, V.S., Professor of Surgery in the Chicago Veterinary College; including an authorised Translation, Enlargement and Re-arrangement of General Veterinary Surgical Pathology, by C. Cadeac, P. Leblanc and C. Carougeau, Professors at the Veterinary High School at Lyons. Royal 8vo, xiii. and 669 pages. Price 18s. net.

The work is written, the author states in the preface, to meet the requirements of the junior student in the three-year course of the American veterinary colleges. It is intended to fill up a gap in English veterinary literature caused by the absence of "books on pathological subjects and the other essentials which form the foundation of surgical knowledge." The book is really one which gives some outlines of bacteriology and pathology, and includes some details of surgical technique. It is divided into two Parts.

Part I. comprises the first 281 pages. It deals with the various forms of inflammation, processes of repair in wounds and after destruction of tissue, infectious granulomata, fever, gangrene, œdema, thrombosis and embolism, gives an introduction to bacteriology, theories of immunity, opsonins and precipitins. The last 100 pages of this portion are devoted to surgical matters: surgical shock, hæmorrhage, hæmostasis, restraint of the patient, anæsthesia, asepsis and antisepsis. In this part, on the whole, a very fair account is given of the matters discussed, but here and there a few rather serious errors have occurred, *e.g.*, the hoof is spoken of as a secretion, as a product of the epithelium rather than a modified portion of epithelium; anthrax is cited as a case in which parenchymatous inflammation appears; in catarrhal inflammation the leucocytes are stated as being the most abundant cells in the discharge or exudate; gangrene is considered synonymous with necrosis.

The author gives a very interesting chapter on surgical shock, of which he has noted several cases in the lower animals, a not very common condition as compared with what occurs in the human subject. The chief causes, he considers, are (1) physical injury; (2) prolonged pain in suffering that is suddenly relieved; and (3) painful and bloody operations. Under the heading of local anæsthesia it is recommended that 5 grains of cocaine hydrochloride should be the maximum dose for the horse and $\frac{1}{8}$ to $\frac{1}{4}$ grain for the dog. These are much smaller doses than used generally in this country.

For the sterilisation of instruments the author advises their immersion in 95 per cent. carbolic acid for a few minutes. The chapters on antiseptic surgery and treatment of wounds are excellent.

Part II. of this book is chiefly a translation of the general veterinary surgical pathology, by C. Cadeac, P. Leblanc and C. Carougeau. It deals with the various forms of wounds and injuries, abscesses, ulcers, fistulæ, erysipelas, malignant œdema, pyæmia, tetanus, actinomycosis, botryomycosis, melanosis, tumours and diseases of bone and cartilage. The subjects treated in this part of the work are dealt with in a masterly fashion. That portion referring to wounds is specially well worth reading. A large place is given to bacteriology and histology.

There are 114 black and white illustrations. The most of them

are only fair. Fig. 75, labelled a cylindrical epithelioma of the intestines of the dog, appears to us more like an adenoma, if it is a section of a tumour or a transverse section of the crypts of Lieberkühn.

The size of the lettering makes the text easy to read. The paper and binding are good.

"THE PROPOSED ANNUAL REGISTRATION FEE."

THE following circular has been issued to the members of the veterinary profession by the committee appointed to consider and report upon the above subject :—

ROYAL COLLEGE OF VETERINARY SURGEONS,
10, RED LION SQUARE, LONDON, W.C.,
July 31, 1907.

DEAR SIR,—The Council of the Royal College of Veterinary Surgeons have in recent years found that their endeavours to serve and promote the general interests of the profession are greatly hampered by the inadequacy of the powers which are committed to them by the Charters of the College and the Veterinary Surgeons Act, and by the insufficiency of the College income.

The income of the College is almost entirely derived from the examination fees paid by students, and the aggregate of these has fallen off to a very serious extent during recent years.

This shrinkage in the College income has not coincided with any altered circumstances tending to reduce the necessary expenditure. On the contrary, the expenses of conducting the professional examinations under the existing curriculum are much greater than they were fifteen years ago, and the expense to which the Council is put in attempting to protect the interests of the profession in conformity with the Veterinary Surgeons Act, has also increased in recent years.

In order that the examinations may be efficiently conducted, and that the Council may be in a position to safeguard the interests of the profession by putting down quackery and preventing encroachments on veterinary rights and privileges in legislation relating to diseases of animals and inspection of animals and meat, it is absolutely necessary that the College income should be substantially increased.

The Royal College of Veterinary Surgeons ought to have both a museum and a library in keeping with its position as the body representing veterinary science and practice in the United Kingdom. The present library and museum are assuredly not in keeping with the position which the profession desires to take in the public eye, but the Council are unable to make them better owing to lack of funds.

The Council have given the most earnest consideration to the question as to how the necessary increase in the financial resources of the College can be brought about, and they have come to the conclusion that the only practicable method is to obtain power to impose an Annual Registration Fee.

It is therefore proposed to endeavour to obtain a new Veterinary Surgeons Act, extending the powers of the Council in various directions, and imposing such an Annual Registration Fee.

The Council confidently believe that the benefits which can thereby

be secured to the individual members of the profession will far outweigh the sum which each member will be called upon to pay.

I am instructed to request you to be good enough to signify on the annexed slip whether the proposal to impose on each member of the College an Annual Registration Fee of one guinea meets with your approval, and to return the slip to me in the accompanying stamped envelope as soon as possible.

Yours faithfully,

FRED BULLOCK,

Secretary and Registrar.

(Slip annexed.)

Translations and Extracts.

TREATMENT OF MANGE IN THE HORSE.

BY M. V. DROUIN, COMPAGNIE DES PETITES VOITURES DE PARIS.

A SHORT time ago a bad outbreak of mange took place amongst the horses at two of the depôts of the company that gave rise to great loss and inconvenience. The first case occurred in a lot of animals that were brought up after a run at grass, but as it was looked on as being merely the phthiriasis that is common at the commencement of the winter they were not isolated or any very serious notice taken, but later on it was realised that a bad outbreak of mange had to be faced. The infected animals were at once isolated, and those that had long coats clipped and the hair burned; they were also well washed and scrubbed with warm soap and water. All sorts of applications in the form of ointments were used, with but indifferent results; furthermore, they were troublesome to apply, requiring a man for each horse. Tobacco juice was also used, but it did not appear to penetrate sufficiently; furthermore, there was always the fear of accidents to both men and animals. The mixture used in the army, viz., equal parts of benzine and ground nut oil, gave better results and was applied with less trouble, but it was no good in chronic cases with thickening of the skin, as it was dangerous to increase the quantity of benzine. Cresyle in the form of an ointment was also open to the objection of being difficult to apply, and in a liniment it was useless.

Gerlach has shown that creosote is one of the best parasiticides known, but M. Drouin found that when mixed with water, or spirit, and soap, as recommended by him, that it had not sufficient power of penetration. An application that is sufficiently powerful and easy to apply must possess the properties of being fluid and able to penetrate the skin in spite of the natural fats that are in it, and these properties he finds are possessed by benzine, but it is too volatile for its action to last sufficiently long, and tar has to be added to fix it. The action can be increased by the addition of creosote.

M. Drouin recommends M. Trasbot's prescription, but without turpentine, which gives rise to pain, and the advantage of which he thinks is very doubtful. The formula is:—

Benzine	...	...	...	...	450 grammes
Tar ...	...	...	...	...	150 ,,
Sweet Oil	...	...	...	...	150 ,,
Soap ...	...	...	...	...	150 ,,
Creosote	...	...	...	...	100 ,,

If the horse had a thick coat he was clipped, but with fine-coated animals this was not necessary; the mane was hogged if the neck was much affected. In slight cases the skin was not washed, but the mixture lightly rubbed in with a brush over half the body the first day, and the remainder the second, the animal being isolated.

In chronic cases where there is great thickening of the skin, the animal is first washed with soap and water. M. Drouin does this in a special manner, smearing the soap on the night before, and then scrubbing it in the morning with a brush and warm water.

The object of this is to soften the thickened epidermis, he finds that about 2 lbs. of soft soap is enough for each horse; he has, however, noticed that in some cases it gives rise to a considerable amount of irritation or even pain.

About midday the skin is sufficiently dry to allow the mixture being applied, but in many cases the epidermis is exfoliated in flakes. The horse is regularly and well groomed to remove the scruff, but if the itching continues the dressing is again put on the affected patches.

The author recommends this plan as being cheap, easily carried out, and quicker in curing than any other he has tried. He thinks that in all probability his method can be improved upon, and he only states what his own experience is, viz., that in a few weeks he eradicated a bad outbreak of mange that had been in existence for several months.

(*Revue Générale de Médecine Vétérinaire.*)

WINDGALL—EXTIRPATION—CURE.

BY SAVETTE.

THE animal, a ten-year-old pony, was very lame from an indurated windgall, and an operation was decided upon. The part was shaved and disinfected, and an Esmarch bandage put on. Two elliptical incisions were made over the windgall, about 3½ inches in length, that joined at each extremity *en côte de melon*, and the contained elongated piece of skin and subjacent connective tissue were dissected out. The lips of the wound were drawn apart with retractors, and the windgall carefully dissected clear of the surrounding structures, till it was only retained in its place by a small pedicle. This was divided, and the tumour removed entire. The wounds were united with three catgut sutures, and a dressing applied in the usual manner. The whole operation was done under an antiseptic spray. The dressing was removed on the eighth day. In a month the pony was going sound, and there was no deformity or scar on the joint.

(*Recueil d'Hygiène et de Médecine Vétérinaires Militaires.*)

PARALYSIS OF THE FACIAL NERVE.

BY JOBELOT.

PARALYSIS of the facial nerve is frequently the result of the horse hanging back in his head collar, and the injury may be on one or both sides, and may be complicated with paralysis of the pharyngeal, superior laryngeal, or hypoglossal nerves, all of which give rise to different symptoms. The author mentions three different cases:—

(1) A case of bilateral facial paralysis implicating the lips, nostrils, cheeks, and pharynx. The animal could drink, but was unable to swallow solid food owing to the paralysed condition of the nostrils. There was roaring during work, but after a time this improved, the animal appearing to have acquired the habit of breathing through her mouth.

(2) A case of unilateral paralysis on the left side. The animal could swallow solid food, but when he drank some of the water ran back through the nostrils, as in a case of pharyngitis. At the same time the posterior parotic region was injured, and the recurrent nerve, which caused roaring. This remained permanent; the facial paralysis was only temporary.

(3) A case of unilateral paralysis on the left side, implicating the nostril, eyelid, and ear. The animal could swallow, but only in an imperfect position. Although the nostril was paralysed, there was no roaring. In all three cases improvement took place slowly, and no treatment seemed to have any influence.

(*Recueil d'Hygiène et de Médecine Vétérinaires Militaires.*)

TREATMENT OF CHRONIC DISEASES OF THE TENDONS IN THE HORSE.

BY PROFESSOR IMMINGER (MUNICH).

INJURIES to the flexor tendons of the horse, both those used for slow and fast work, are well known to every practitioner. In many cases, when the feet have been neglected for some time, and the toe has grown too long, the bearing of the foot is thrown out of line, and the tendons, "usually the perforans," are swollen and enlarged. In hilly countries such accidents take place suddenly from a rupture of some of the fibres, and at first the owner attaches but little importance to it; but as more fibres are broken the matter becomes serious.

If the injury is only a slight one, the ordinary methods of treatment, blisters, bandages and the cautery, with appropriate shoeing, will have good results; but if the lesions are severe they will be useless. The author has performed tenotomy of one or both tendons, but without success, and now finds the best results are obtained by pyropuncture. The operation should not be attempted at too early a stage, two months, at least, should be allowed to elapse.

The overgrown part should be pared down and brought to its normal condition. The limb should be shaved, cleaned, and kept for forty-eight hours in bandages wet with an antiseptic. The animal is placed under chloroform. The author, after trying many instruments, is in

favour of Dechery's thermocautery, with needles varying from 16 to 35 mm. long by about 2 mm. in diameter. These needles easily bend, and it is advisable to have a pair of pliers at hand to straighten them.

The needles must be very hot, so as to easily penetrate the skin and to be quickly withdrawn, or if left in contact with the tissue for too long the surrounding tissue is necrosed.

The number of punctures required varies, often sixty are required, and it is advisable that the puncture should be oblique, so that the points converge towards each other. The inner side of the limb should first be operated on, and if a vein or one of the sheaths of the tendon is punctured it is of no importance. The limb is dressed over with iodoform and collodion, and then a bandage that is kept wet for several days with a solution of corrosive sublimate is put on. The horse is kept tied up short.

For about two days there is great pain, especially if both legs have been fired, and in many cases there is a rise in temperature, but this need not create any alarm.

The animal should not be moved for ten days or a fortnight, when he should be given about ten minutes' walking exercise. After about six weeks he may be lightly worked.

The author has used this method for the past three years with good results.

(*Tierärztliches Zentralblatt.*)

SECTION OF THE SCIATIC NERVE FOR CHRONIC LAMENESS FROM A GATHERED NAIL IN THE FOOT THAT INJURED THE NAVICULAR BURSA.

BY DEYSINE.

THE animal had a gathered nail and injured the navicular bursa. Three months after he was very lame. The author divided the sciatic nerve and the animal went sound on the fifteenth day. He has since done his regular work, although the foot is still deformed and at times hot.

(*Recueil d'hygiene et de Médecine Vétérinaires Militaires.*)

SECTION OF THE ANTERIOR TIBIAL NERVE.

BY INGUENEAU.

THE author has performed this operation successfully in six cases of spavin. He operated under antiseptic conditions, and in every instance obtained healing by first intention.

About the tenth day the hock joint was swollen, hot and painful, but this quickly subsided, and in a month all the patients were back at work.

In some cases he has found that the operation brings about instantaneous relief.

(*Recueil d'hygiêne et de Médecine Vétérinaires Militaires.*)

TREATMENT OF WOUNDS TO TENDONS AND JOINTS WITH CRYSTALLISED BORACIC ACID.

BY BURY.

PURE crystallised boracic acid applied freely to a wound will saturate the surrounding tissues, and appear to act as a preventive to inflammation and suppuration even when there is no other dressing used. Not being poisonous its absorption is harmless. When introduced into a joint it slowly coagulates a small amount of synovia. The author for some time past has used it successfully in the treatment of severe injuries, such as gathered nails, broken knees, and open joints.

(*Recueil de Médecine Vétérinaire.*)

DANGERS OF TARTAR EMETIC.

BY GUNTER.

THE author reports three cases that occurred in his practice in which horses showed marked susceptibility to the action of this drug.

In both cases 12 grammes were given as a vermifuge, and only vigorous treatment saved the animals.

The author thinks that practitioners should be on their guard when prescribing tartar emetic, although the dose given in standard works is nearly double.

(*Deutsche tierärztliche Wochenschrift.*)

TREATMENT OF INFECTED CONTUSED WOUNDS.

BY PROFESSOR SCHWENDIMANN (BERNE).

SADDLE and collar galls are about the most difficult class of wounds to treat that are met with in everyday practice, as there are almost always complications in the healing process. This is more particularly the case where the injury is to the withers.

The serious nature of such accidents is due to a variety of causes, but more especially on account of the movability of the skin and the large masses of muscle that are in this region, also the fact that it is largely made up of bones, cartilages and ligaments. Wounds in this particular region are specially liable to give rise to other complications, such as stable pneumonia, purulent infection, and cicatricial neuralgia; furthermore, treatment takes a long time, often a matter of months.

It should be carefully remembered that such wounds are both aseptic and antiseptic, and neglect to distinguish between these two classes may give rise to the gravest consequences, an antiseptic hygroma being early turned into an infected wound, with all sorts of complications following in its train.

In addition to surgical interference, there are a number of other circumstances that must be recollected in treating such injuries. In the first place the patient must be kept quiet, and all movements of the head and neck prevented as much as possible; he must be exercised

in hand and not ridden, and last, but not least, his surroundings must be in the strictest sanitary condition. Flies are most objectionable, as they irritate the animal, and make him constantly fidget; for this reason treatment is most difficult during the autumn months.

The principal accidents are necrosis of the skin, abscess and fistula of the withers, with sloughing of the skin.

(1) *Necrosis of the Skin.*—This takes place by dry gangrene and mummification. Damp heat and antiseptic dressings should be used to prevent sloughing off of the dead tissue. If suppuration sets in, care must be taken that the pus does not burrow into the deep tissues, especially if the wound is at the top of the withers. In such cases the dead tissues must be removed and the wound dressed with an antiseptic.

(2) *Abscess on the Withers.*—The old surgical axiom, "Ubi pus ibi evacua," holds good. When the skin is intact there is a natural tendency not to interfere with it, but to apply blisters, &c., at the risk of the pus being reabsorbed. The part can be punctured with a trocar or a pointed cautery. It is better to evacuate the pus by repeated pressure than continual irrigation.

(3) *Fistulous Withers.*—Generally accompanied with necrosis of the bones, cartilages and ligaments. Prognosis is always uncertain, often bad. As a rule, the application of ointments, blisters, &c., and the actual cautery are useless, and only waste of time.

In some cases fistulæ heal spontaneously, but such are exceptional, and before undertaking one it is advisable to consider if the value of the animal justifies the outlay of time and money.

Surgical interference is of course necessary, the main objects to be kept in view being the removal of the dead tissues, and creating a drain for the collection of pus.

In deep-seated fistulæ the general indications are to open the fistulæ their entire length with a large strong scalpel, and remove the diseased tissue. The divided vessels are tied and hæmorrhage stopped, the large resulting wound being sutured and a drainage later fixed in the corner angle. The wound is covered with a thick paste of airol, and the patient kept in slings for ten days.

The author strongly condemns the washing or irrigating the wound with antiseptic fluids. By this plan he has had old-standing cases heal by first intention, although he confesses that this happy termination is not so frequent as he could have wished, as the skin may heal by first intention, leaving the fistula filled up with granulations. In such cases he recommends that the discharge should be got rid of by pressure rather than irrigation.

(4) *Atrophy of the Skin.*—This is caused by a subcutaneous collection of pus on the sides of the withers, and frequently takes place after an abscess has been opened. It is due to the great mobility of the skin at this part of the body. The skin becomes thin, damp, shining, and covered with granulations that give it the appearance of a mucous membrane, and loosened from the subcutaneous tissues.

Cases of this nature last for a long time, frequently many weeks. The author finds that the best results are obtained by pyro-puncture, the punctures being applied about 1½ inches apart; the inflammatory process set up causes adhesion of the detached skin.

(*Schwiezer Archiv. für Tierheilkunde.*)

SALIVARY CALCULI.

BY LEGENDRE.

In the animal that was brought to the author's notice he found three small tumours the size of a nut in front of the masseter muscle, and below the zygomato-labial, on a level with the lower row of teeth, that proved to be salivary-calculi. The first was extracted externally, and left a fistula that would not heal up. The other two were removed by the mouth, and caused no complication. The author makes the following remarks:

(1) Salivary calculi are very common in barbs that are fed on barley between 11 and 12 years of age.

(2) It is not advisable to extract the calculus externally. The difficulty in operating internally from the thickness of the alveolo labial muscle which has to be incised, and the movement of the tongue and jaws, should not be allowed to stand in the way.

(*Recueil d'hygiene et de Médecine Vétérinaires Militaires*).

Books and Periodicals, &c., Received.

Cape Colony Agricultural Journal; Tropical Agriculturist (Ceylon); Transvaal Agricultural Journal; "The Principles and Practice of Veterinary Surgery," by Louis A. Merillat (Baillière, Tindall and Cox); "Horses, Breeding to Colour," by Sir W. Gilbey (Vinton and Co., Ltd.); "The Pig in Health, and How to Avoid Swine Fever," by Sir W. Gilbey (Vinton and Co., Ltd.); Report of the Chief Veterinary Surgeon of the Cape of Good Hope; London University Gazette.

Letters and Communications, &c.

Professor Craig; Mr. T. A. Ford; Mr. R. MacGregor; Mr. E. Merck; Royal College of Veterinary Surgeons.

Note.—All communications should be addressed to 8, Henrietta Street, Covent Garden, London, W.C. Telephone, 4646 Gerrard. Telegrams, "Baillière, London."

Letters for the Journal, literary contributions, reports, notices, books for review, exchanges, new instruments or materials, and all matter for publication (except advertisements), should be addressed to the Editor.

Manuscript—preferably type-written—should be on one side only of paper, marked with full name of author.

Illustrations for reproduction should be in good black or dark brown on white paper or card.

Advertisements and all business matters relating to the Journal should be addressed to the publishers, Messrs. Baillière, Tindall and Cox.

All authors desiring reprints of their articles will be supplied with copies free of charge upon requesting same within a week of publication of the Journal.